AUTOMOTIVE and Aviation INDUSTRIES

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FEBRUARY 1, 1944

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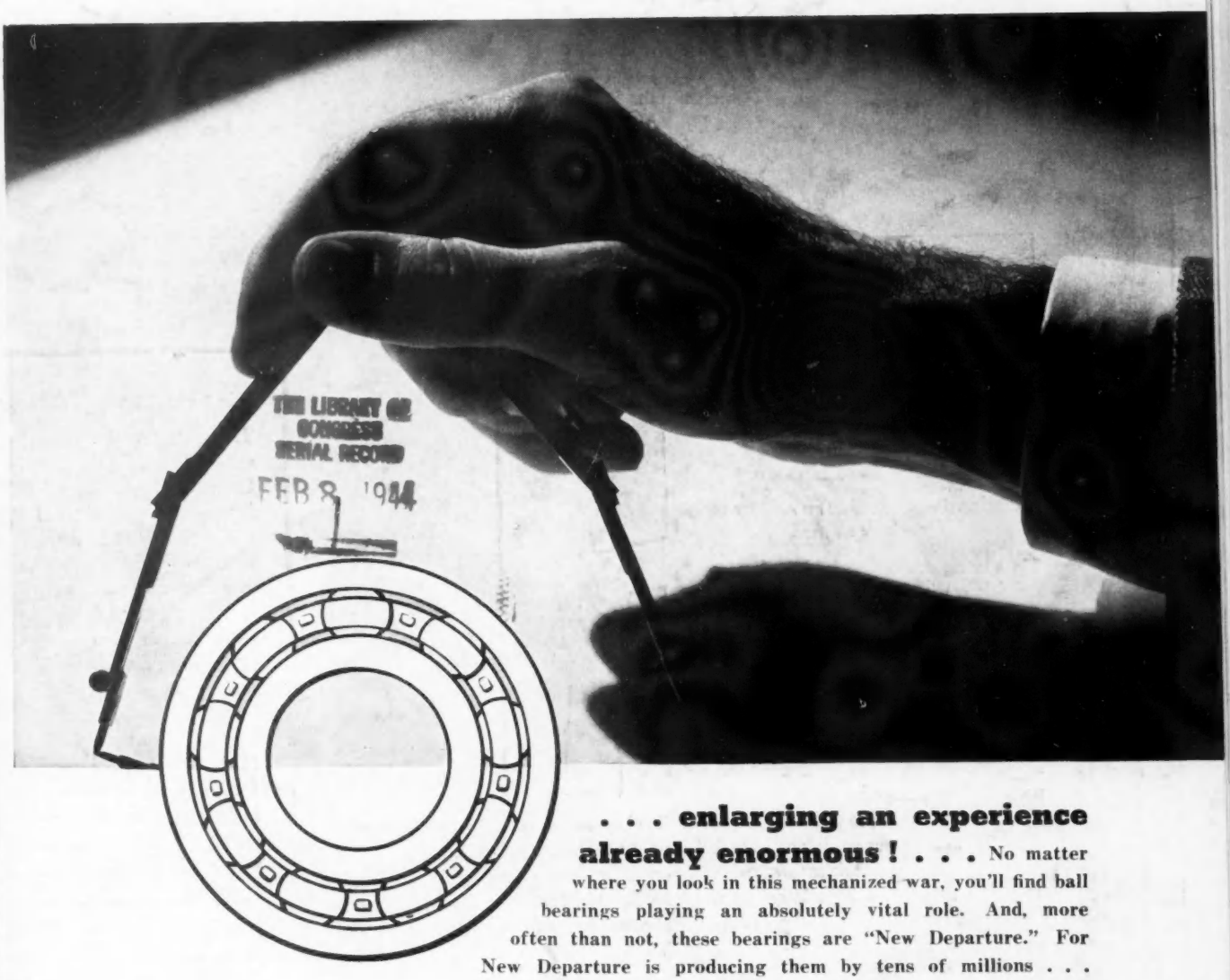

. . . enlarging an experience already enormous! . . . No matter where you look in this mechanized war, you'll find ball bearings playing an absolutely vital role. And, more often than not, these bearings are "New Departure." For New Departure is producing them by tens of millions . . . thus enriching and enlarging an experience already enormous. New Departure, Division of General Motors, Bristol, Connecticut.

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. . . Nothing Rolls Like a Ball

3225

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Cutting oil *News* letter

Practical suggestions from the field on how cutting oils and coolants are being used by midwest machine operators to lick tough wartime jobs.

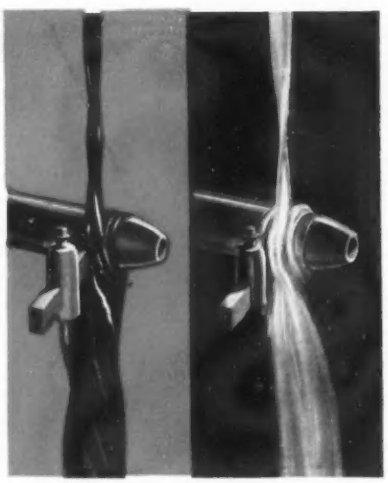
FEBRUARY, 1944

Find thread chasers an awful grind? Try Stanicut. Dies for threading aluminum parts taxed the tool department in an Illinois war plant. In cutting a 1⅛"–16 external thread, chasers had to be ground every three days. Then Stanicut 137BCS was put on the threading operation. Dies lasted 25 days before they needed regrinding. Less grinding meant less tool stock wasted, less tool maker's time needed, and more parts produced.

Outboard motor used as an agitator in big soluble oil tank

Big saving for big soluble oil user. Soluble oil is used in large quantities by a manufacturer turning out 105 mm. shells. The central mixing tank which feeds the machine is so large it is agitated by an outboard motor. When this war job was started no expense was spared to avoid trouble. A rich solution of an expensive oil was used. Later, tests of other oils were made. Superla Soluble Oil was one of these. With it, mixes as high as 25 to 1 are doing finished work satisfactorily. These lean mixes of Superla have cut soluble oil costs to ⅓—a 4-figure saving yearly at this plant.

Cutting oil in place of kerosene doubles tool life. Machining bronze on a turret lathe wasn't a particularly difficult job at one Indianapolis plant. Kerosene was used as a coolant. Its viscosity was low, it did not stain the work, and it was easy to get. But tool life wasn't exactly good. One of the new Stanicut oils, developed to meet the increase in machining of non-ferrous metals in war plants, was tested. It, too, had the right viscosity and cooling qualities, did not stain the work, and was readily available. But it also doubled tool life. Take advantage of new cutting fluid developments by talking over your machining, grinding, and stamping problems with a Standard Cutting Oil Specialist.



Cutting oil or soluble oil? When in doubt try Stanicool H. D. Many factors enter into the question of which coolant to use, cutting oil or soluble oil. Sometimes neither does the *whole* job. With a soluble oil, even in concentrated mixes, tool life may be poor. With cutting oils, cooling may be inadequate, resulting in poor finish and burned tools.

Stanicool H. D., a heavy-duty soluble oil, has been the answer in many plants. The job of boring, turning, and facing forged gear blanks was one example at a central Illinois plant. Excessive smoking and overheating occurred when a cutting oil was used. A conventional soluble oil gave poor tool life. Stanicool H. D. mixed 7 to 1 eliminated the smoking. Gear blanks came off of the machine considerably cooler. Stanicool H. D. gave satisfactory tool life plus an extra dividend in lower oil costs.

What are YOUR problems?

The few examples cited here are typical of jobs Standard Cutting Oil Engineers are doing daily for operators who have asked for help. Take the time to explain your problems to one of these Engineers. He may have a number of suggestions that will help you save much needed manpower, materials, and tools. Call any Standard Oil Company (Indiana) office, or write 910 South Michigan Ave., Chicago 5, Ill., for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

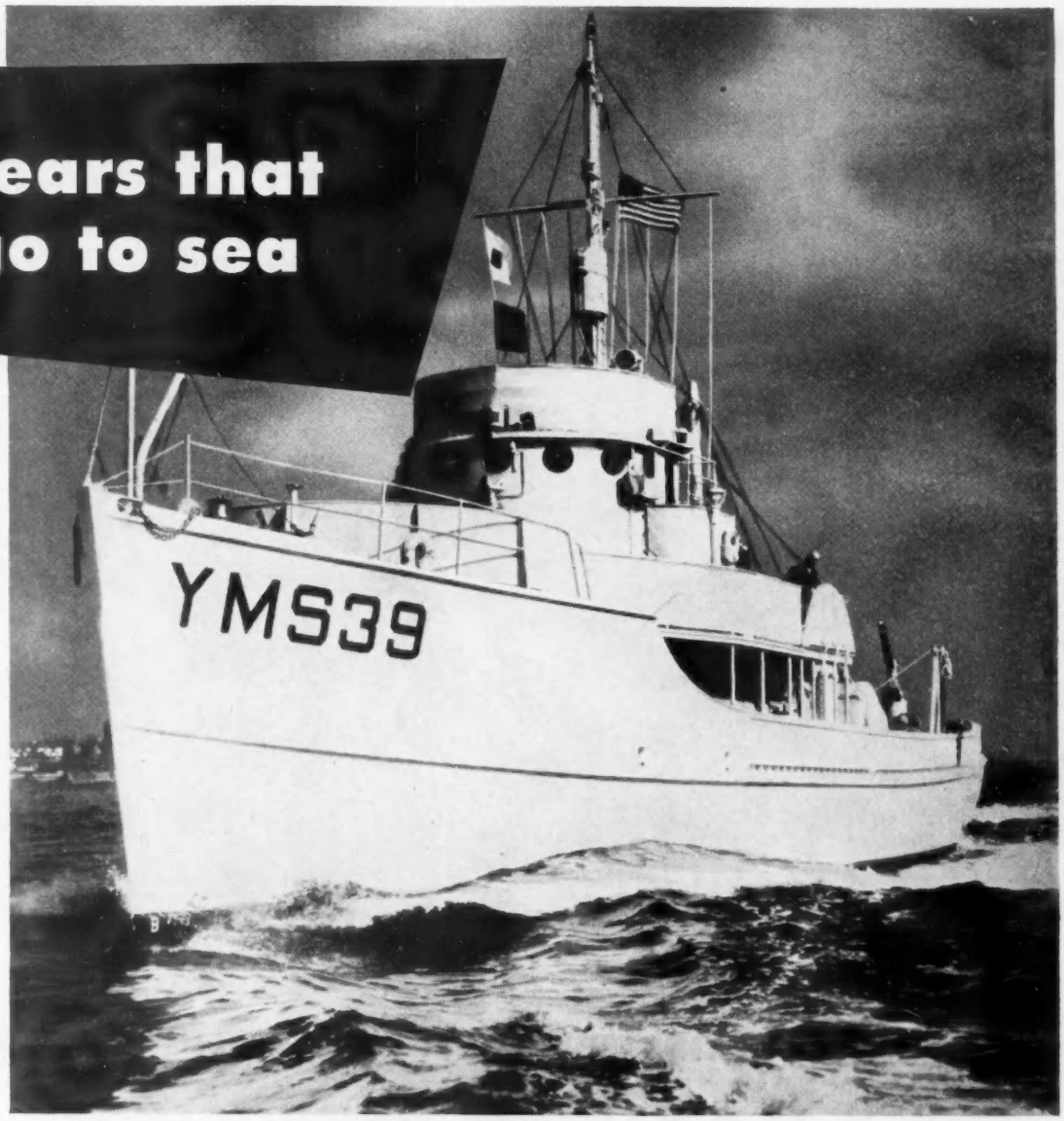
Oil is Ammunition . . . Use it Wisely

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING

FEB -7 1944

Gears that go to sea



OFFICIAL U. S. NAVY PHOTO

Only winches with bull-dog characteristics need apply! . . . because sea-going service on Uncle Sam's mine-sweepers is a racking grind, calling for the ruggedest kind of gear-boxes. That's why you find COTTA Transmissions in winches made by the Lidgerwood Manufacturing Co., Elizabeth, N. J. and by the United Steel Corporation, Ltd., Canada. For over 30 years, COTTA has been a source of custom-designed transmission units, for locomotive cranes, Diesel locomotives, oil-well drilling rigs, power excavators, and the like. Whenever there is need for smooth, quiet, highly efficient, low-cost transmission of power, precision-built to fit the space you have available, . . . come to COTTA! A letter outlining your problem will get prompt attention . . . or write for *free* brochure today!

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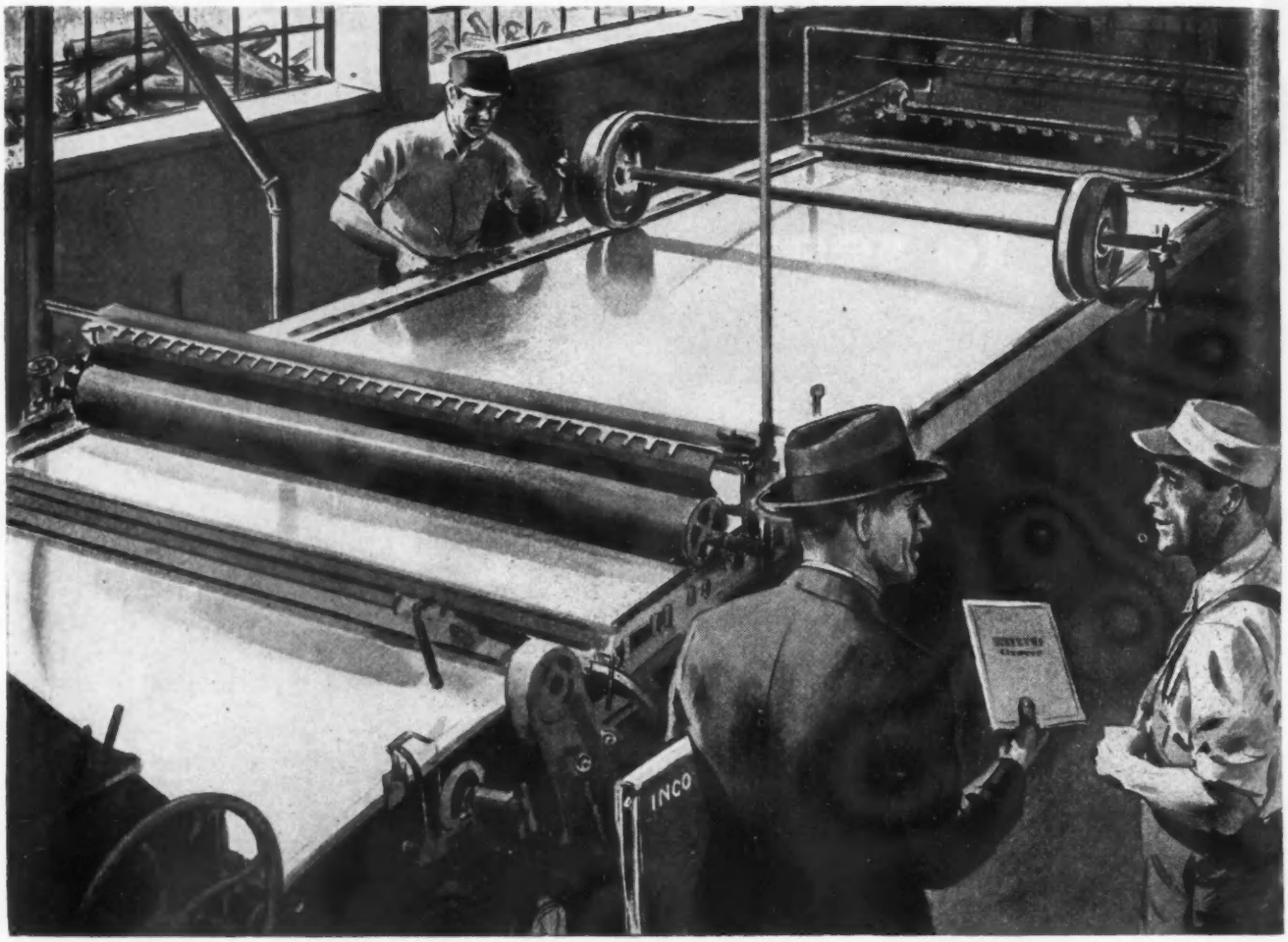

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to KEEP 'EM PRODUCING!

"Paper is one of the sinews of war" . . .

A basic tool of communication . . . strategic substitute for metal in many products.

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So the need is tremendous . . .

And the industry's vast output is possible largely because paper-making is almost entirely a machine process.

Plant engineers agree that when you depend so much on machinery, you'd better have machines that are dependable.

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AUTOMOTIVE and Aviation INDUSTRIES

Published Semi-Monthly

Vol. 90 — February 1, 1944 — Number 3

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Cable Address ..... Autoland, Philadelphia

Member of the Audit Bureau of Circulations
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AUTOMOTIVE and AVIATION INDUSTRIES is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Owned and Published by
CHILTON COMPANY
(Incorporated)

Executive Offices

Chestnut and 56th Streets, Philadelphia 39, Pa., U. S. A.

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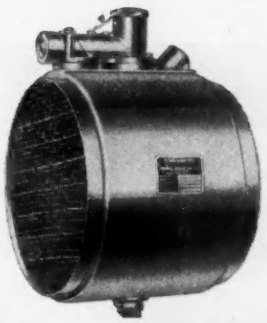

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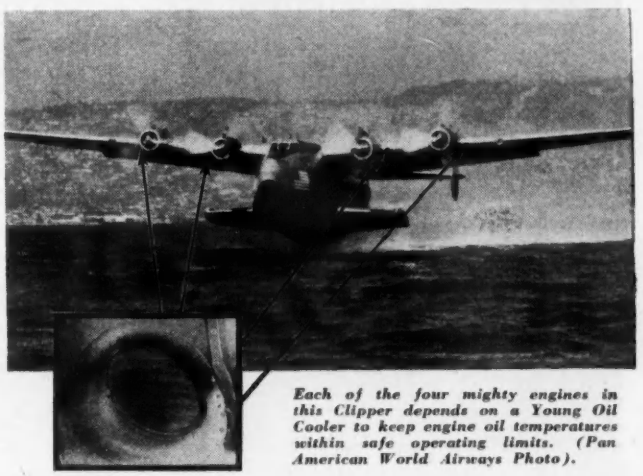
OIL COOLERS for CLIPPERS



Each of the four mighty engines in this Clipper depends on a Young Oil Cooler to keep engine oil temperatures within safe operating limits. (Pan American World Airways Photo).

Young is proud to have had a part in spanning the skyways of the world. Experience that began thirty years ago made it possible for Young Heat Transfer Products to contribute to the amazing development of commercial aviation, climaxed by giant Clipper ships encircling the globe. When war broke out Young engineers were ready! They produced equipment that could stand the punishment of fast flying, long trips, furious fighting. They did more... they developed automatic accessories and controls to regulate temperature and flow of coolants for quick take-offs, power dives and steep climbs, thus freeing pilots and crews for concentration on combat. And now, though still deep in war work, Young engineers are finding time to put thought on the heat transfer problems of the postwar world. Consult with them, without obligation.

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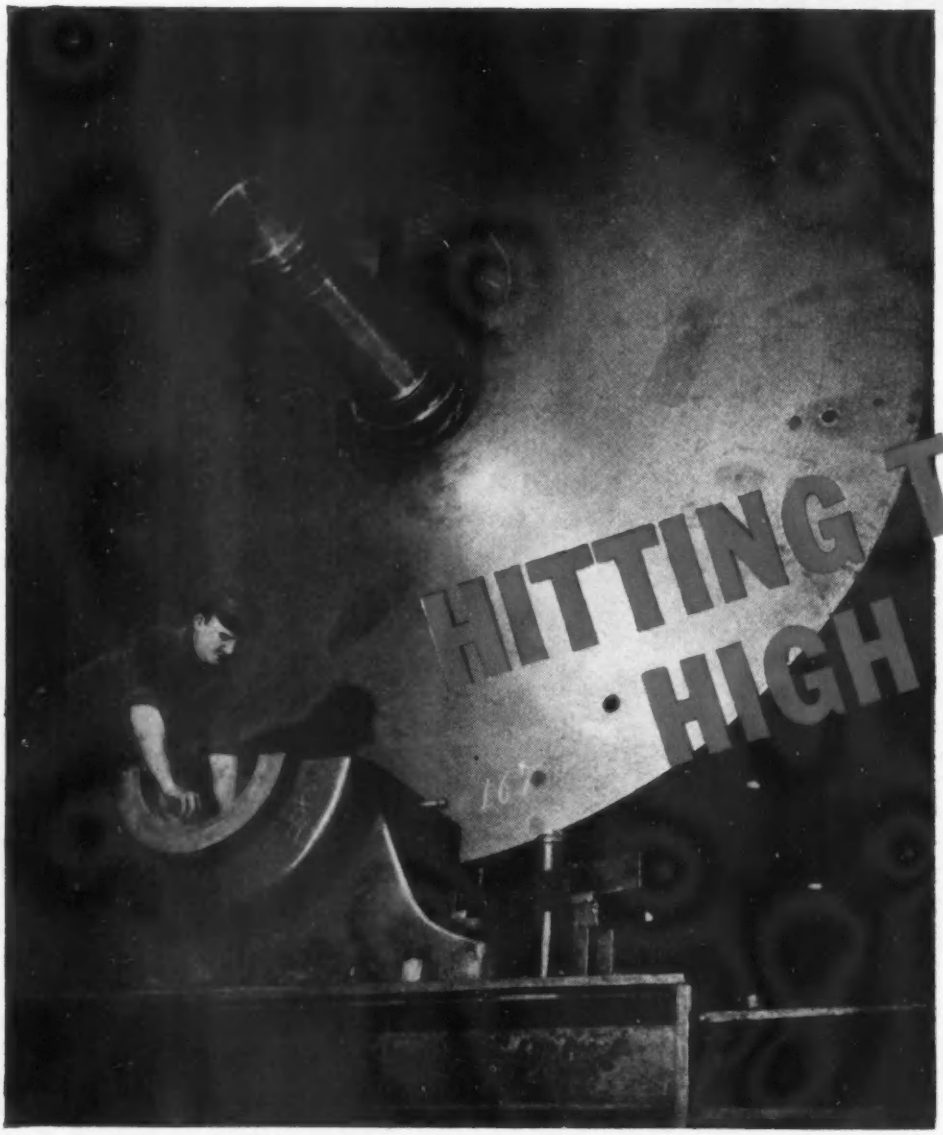
AUTOMOTIVE *and* AVIATION INDUSTRIES. Vol. 90, No. 3. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. 39. Entered as Second Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries, $1.00 per year. Canadian and Foreign $2.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 15th), 50 cents.



HITTING THE HIGH SPOTS

WHEN this 14-foot 38-ton flywheel starts turning up 500 rpm's, the first integrated steel mill on the Pacific Coast will be in operation . . . an interesting wartime development.

An equally outstanding war development is the greatly increased cutting-tool life which war plants everywhere are getting, by using *Texaco Cutting Coolants.*

For example, in producing bomb fin liners, a certain forming tool required sharpening every 8 to 10 hours. Changing to Texaco, the tool now averages 50 hours between grinds.

So effective have Texaco lubricants proved that they are definitely preferred in many fields, a few of which are listed at the right.

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★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

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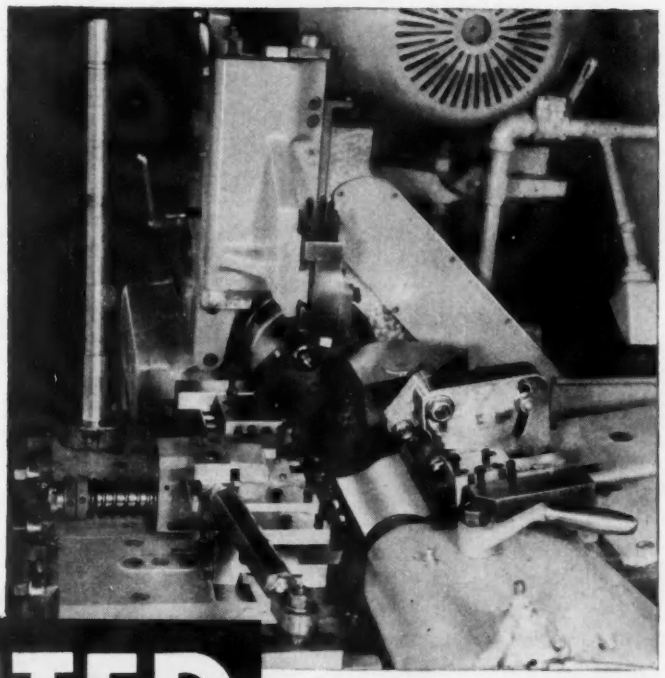
TUNE IN FRED ALLEN EVERY SUNDAY NIGHT – CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

MODEL "LR" *Lo-swing*

Illustration at right shows tooling of a Model "LR" equipped for turning an Automobile Transmission Shaft. Equipment furnished consists of one three-slide Front Carriage; two Back Attachments, one carrying tools, the other a two-roll steady rest; one Top Slide; one 45° Undercutting Attachment.

The automatic cycle is as follows: First, the tools on the center slide of the Front Carriage spot the shaft for a Steady Rest bearing; Second, Steady Rest on Back Attachment moves in automatically to support work; Third, all tools start cutting simultaneously, those on Front Carriage turning all diameters, tools on Top Slide face and groove, tools on Back Attachment chamfer and groove while the Undercutting Attachment tool undercuts the head end at a 45° angle. The operation is entirely automatic. Operator merely loads and unloads and pushes starting lever.



UNLIMITED
TOOLING POSSIBILITIES ARE AVAILABLE WITH THE LATEST TYPES OF AUTOMATIC *Lo-swing* LATHES

Lo-swing IMP

At left is a close-up illustration of an Imp Lathe equipped for turning, facing and rough and finish grooving aluminum pistons on a production basis.

The work is held and driven by an air-operated Wrist Pin Type Driver. The three tools mounted on the front carriage turn the skirt, ring groove lands, and round the end of the piston, while simultaneously the tools on the top slide face the end and rough turn the grooves. Immediately these tools have ceased cutting, the finish grooving tools on the rear slide finish the grooves to close tolerances.

The cycle is automatic . . . the operator simply loads and unloads the pistons and pushes the starting lever.

SENECA FALLS MACHINE CO.
SENECA FALLS, NEW YORK

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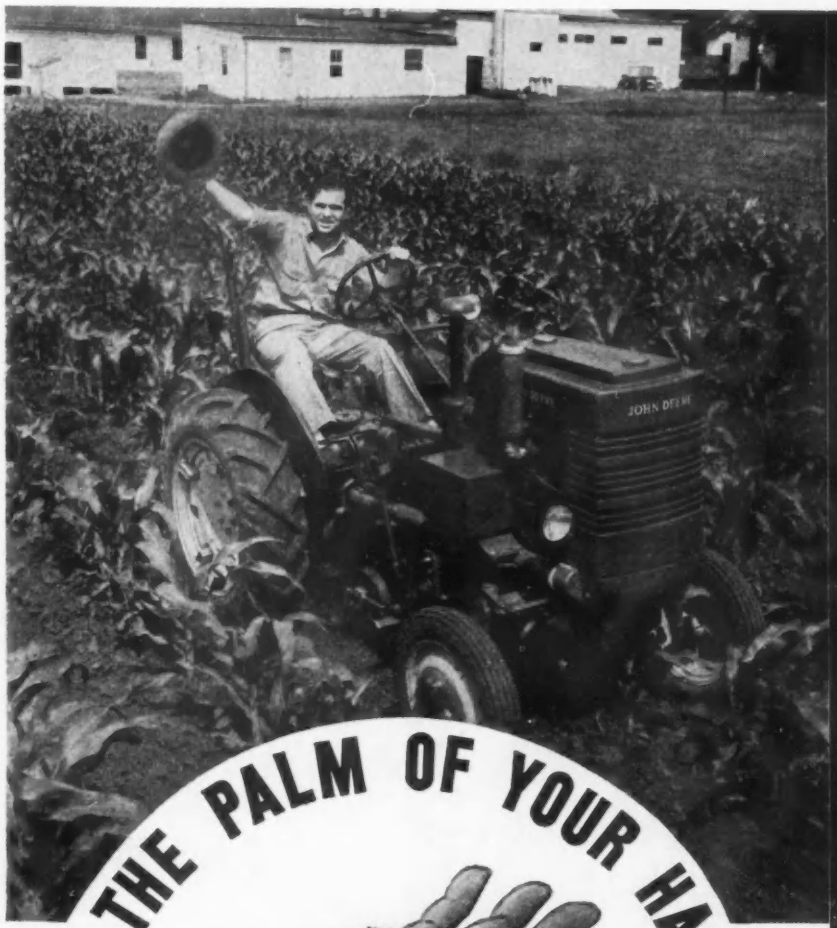

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. . . YOU CAN HOLD ENOUGH DUST TO WEAR OUT A TRACTOR, AUTOMOBILE, TRUCK OR ANY INTERNAL-COMBUSTION ENGINE.

For the past 14 years United Oil Bath Air Cleaners have protected engines from damaging abrasive action of dust and dirt-laden air — and new models of cleaners will give better protection to improved engines of tomorrow. Our knowledge and technological experience gained in furnishing hundreds of thousands of air cleaners and other units for many diverse military uses, will be reflected in an even higher standard of performance of United products after the war.

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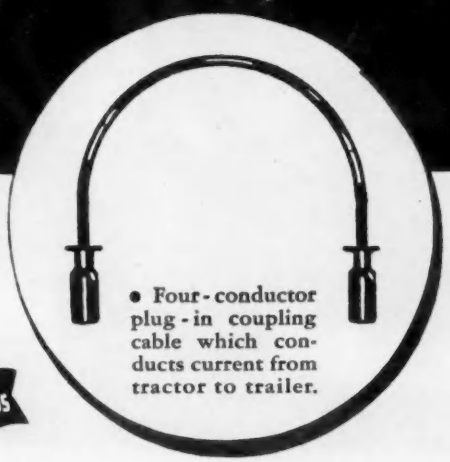

• Four-conductor plug-in coupling cable which conducts current from tractor to trailer.

• The Warner Coupling Socket is serving all the way up the line — from the tiny jeep to the largest truck used by our armed forces.

For years, this proved-in-service socket has been standard equipment on many tractor-trailer fleets — used with our plug-in coupling cable to conduct current from tractor to trailer for brakes, tail light, stop light and running lights. To these standard functions, a wartime requirement has been added—blackout lights.

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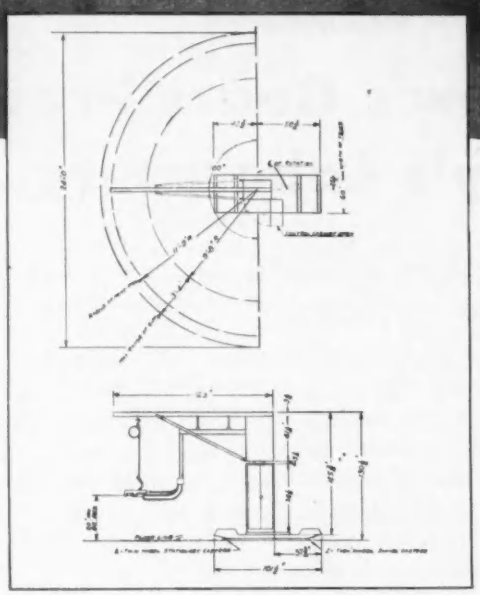
HELPING TO SOLVE TODAY'S WARTIME PRODUCTION PROBLEMS



Dimension drawing of Sciaky Type PS2R-1, 100 KW, Radial Portable Spot Welder, showing maximum reach of gun and 180° rotation. Capacity: Aluminum and light alloys in two thicknesses of .016" minimum up to and including .064"—corrosion resisting steels up to two thicknesses of .080".

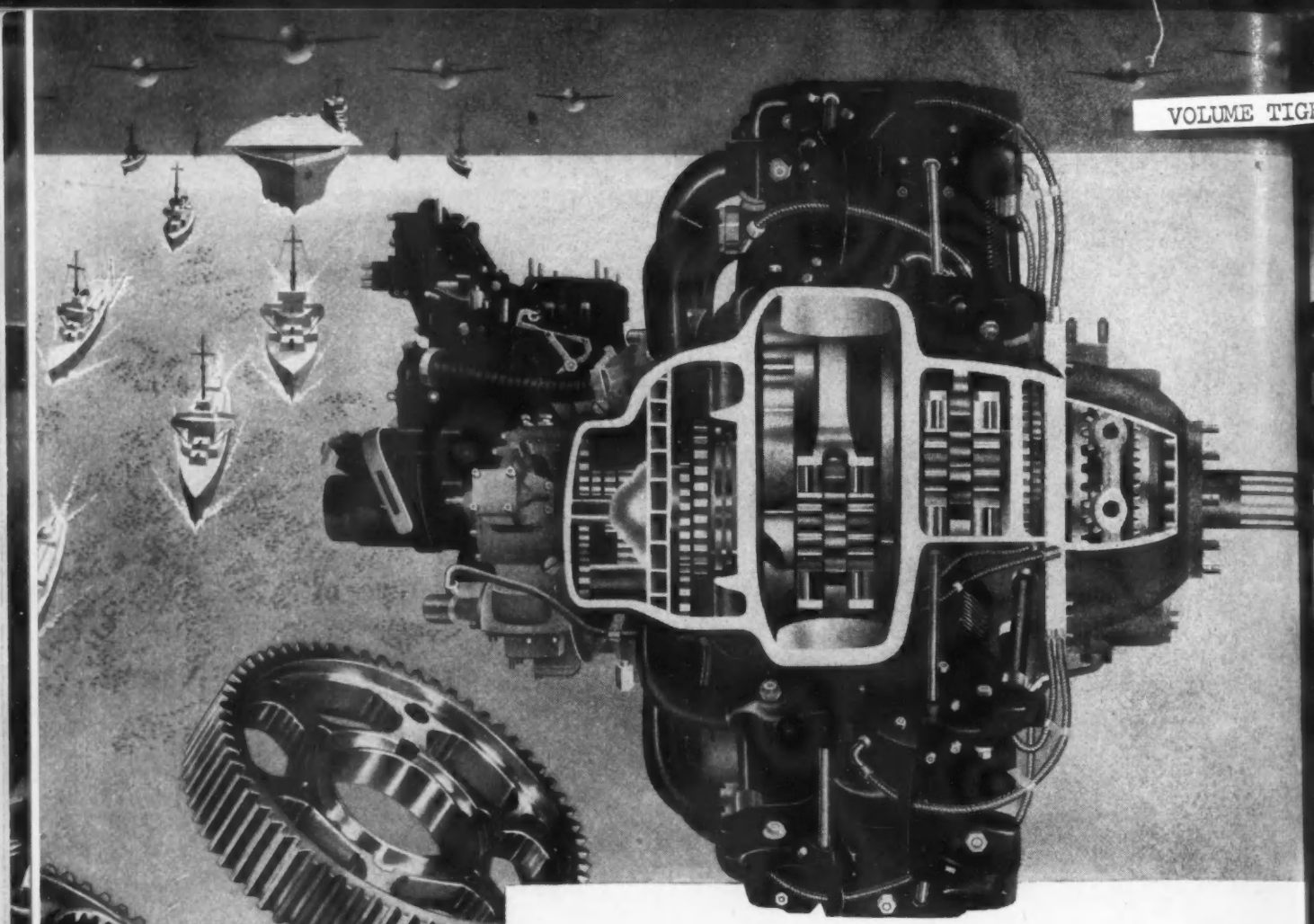
it reaches your welding problems

This radial portable spot welder for aluminum and light alloys will fill a long felt need in the fabrication of light structures. Sciaky engineering now makes it possible to bring the advantages of aluminum spot welding *to the assembly.* Crowded and fixed jigs can be easily reached. Tacking operations as well as structural welding can be accomplished with greater speed and efficiency.

Stored Energy with Preheating and Variable Pressure, features which are established as superior in the welding of aluminum, are employed. The control cabinet, main welding reactor, monorail and special copper bars connecting the gun to cables are all built as a self contained unit. This unit is mounted on a stationary column and pivots on a vertical axis by means of ball bearings mounted inside the column. Transversal movement of the gun on a straight line can be 12 feet in length. The gun may also be moved vertically 20 inches above and below a minimum position.

SCIAKY BROS.

Manufacturers of a Complete Line of
A.C and D.C Electric Resistance Welding Machines
4915 W. 67th Street, Chicago, 38, Illinois



Tomorrow's Gears Proved in Today's Laboratory . . .

EVER look inside a Twin Wasp engine? Here the power of 1200 horses is packed in a space no wider than your outstretched arms.

And notice the gears in this mighty engine—gears so compact and necessarily so light in weight that only extreme precision makes it possible for them to carry their tremendous load.

In the three precision gear plants of Foote Bros. new manufacturing methods, new technical developments plus the skill and "know how" of Foote Bros., engineers are today producing these high precision gears in amazing quantities. Outstanding developments in heat-treating and carburizing—an exact metallurgical control—the latest improvements in gear checking instruments—all these plus the skill an knowledge of a force of experience men and women numbering more tha 6,000 assure volume production these metallurgically and dimensio ally perfect gears.

Tomorrow when victory is ours, th precision gear production achieved the plants of Foote Bros. promise American manufacturers a new eco omy in the transmission of power. Fo in compact speed reducers and aircra devices—in marine motors and ge trains as well as in Pratt and Whitne engines, these precision gears are t day showing the way to new standard in engineering which may be devote to peacetime production when the w is won.

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5225 South Western Boulevard • Chicago 9, Illinois

ARMY E NAVY

FOOTE BROS

Better Power Transmission Through Better Gear

E TIGHTLY BOUND

Ex-Cell-O machine illustrated is an opposed Style 58 two-way machine arranged with six boring spindles at each end for finish boring, counterboring and facing the gear holes in an aluminum supercharger cover. All spindles operate simultaneously, finishing the holes within .0005" at a highly satisfactory production rate. The units have 20 inches of table travel and 15¾ inches between the ways. Each spindle is individually adjustable for quick setting. In this particular application all centers are set to a master gage, which, in effect, is a master for the part itself.

INCREASING PRODUCTION . . .

with new economy!

Ex-Cell-O Unit-type Precision Boring Machines Bring Added Practical Features

Ex-Cell-O has developed standard boring units, each a complete machine in itself, yet by means of heavy flanges and bolts these units can be bolted singly or in multiples to a stationary center section, resulting in a multiple precision boring machine. Note these advantages:

It is still a *precision* boring machine. Bores may be finished in tenths of thousands as before, yet units may be mounted in multiples and at angles, all operating simultaneously toward the center section.

Because all units may operate simultaneously, production is considerably increased on many parts.

The unit-type construction allows for salvage of all but the fixtures in case of part changes. It is possible and economical merely to remove and replace the entire center section. This means a flexible machine on which maximum production can be obtained while the machine is set up.

Each way or unit has two feeds and a dwell in forward and reverse direction, and each can be controlled individually or by a central control button in conjunction with all other units hooked into the electrical panel. It is completely automatic except for loading and unloading.

More than most semi-special machines, this Ex-Cell-O machine incorporates desirable features in flexibility and production, for war work today and peacetime products tomorrow.

EX-CELL-O CORPORATION • DETROIT 6, MICH

Ex-Cell-O has just printed a new folder on Unit-type and other Way Machines. A copy is yours for the asking. Send to Ex-Cell-O Corporation, Detroit 6, Michigan, and specify Bulletin 31631.

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WORK *FASTER* WITH P&H ZIP-LIFT HOISTS

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Zip-Lifts save effort, too—let workers be *good* workmen all day by reducing fatigue to a minimum.

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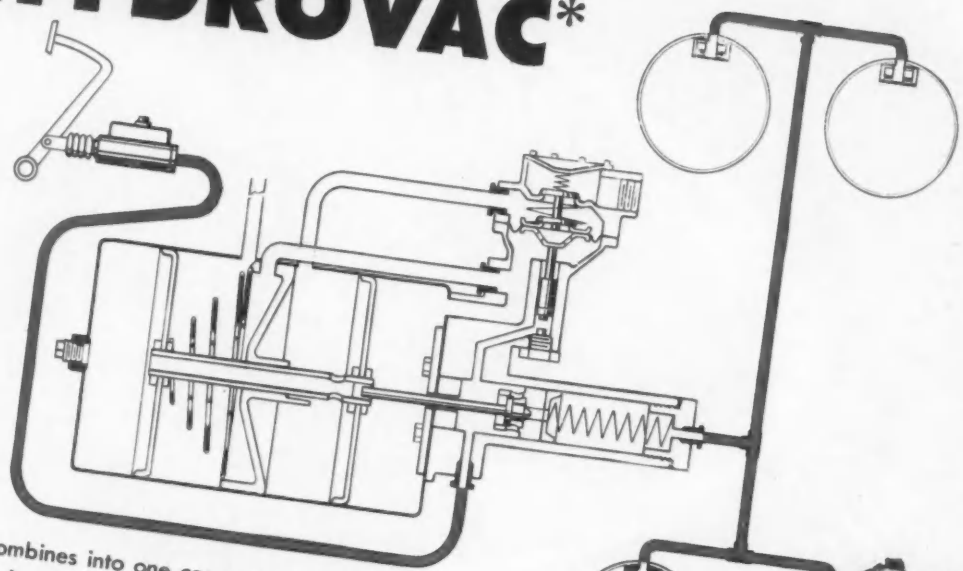

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THE INVISIBLE CREW
Precision Equipment by
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IN THIS ISSUE . . . .

AUTOMOTIVE and AVIATION INDUSTRIES

Volume 90 February 1, 1944 No. 3

Flexibility of Operations 20

An impressive list of items for the war effort is being turned out at the Aluminum Industries, Inc., by virtue of their know-how and the availability of diverse facilities. The unusual technique in the handling of their production lines is a story well worth the time of the reader.

Light Drive Fits 24

Light drive fits of steel and duralumin bolts are specified in many of the aircraft assemblies. They are presenting some difficulties. Here are the answers to the puzzling questions.

North America's B-25C and D Bomber 26

Complete with drawings and views, detailed in text, this article carries the reader right down the line of both construction and design.

Goodyear Aircraft's Rapid Growth 32

Goodyear Aircraft Corp. was formed in 1939 to take over contracts in airframe parts. With a background of experience in aerodynamics and structural aluminum the company has shot ahead and reached an almost unbelievable peak of production. Its employes mount up into the big figures and the factory floor space has grown from square feet into acreage.

Predicting Tractor Bearing Life 36

In this article the author, with a most authoritative background, goes into figures and formulae that answer almost any question pertinent to this knotty subject.

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

When Initiative Has The Green Light

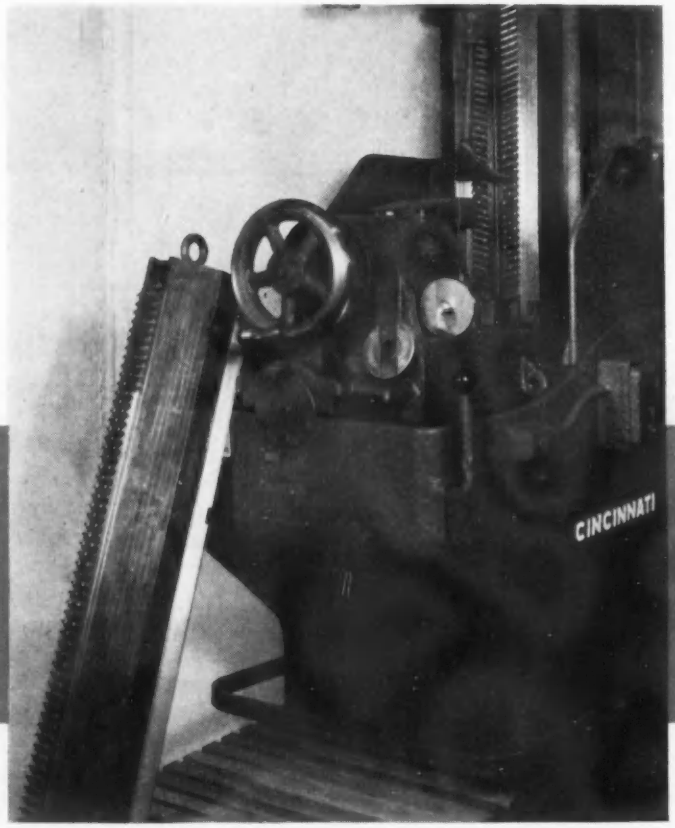
By James R. Custer

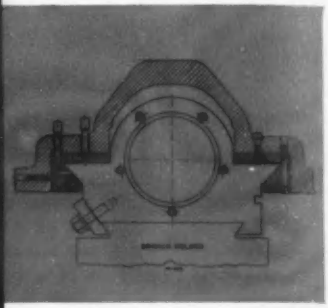
WHAT single force has been the most potent contribution in making America's industrial strength the greatest in the world today? The answer is not to be found in the theorizing of the classroom or in the soothsaying of the politicos, nor in the administration of the bureaucrats. For it, we must go to the histories of our great and small industries—to the automotive industry, to the aviation industry, to the petroleum industry, to the machine tool industry, to the metals industry, and many others. The answer is the initiative of individuals and groups who have dared to achieve progress in the face sometimes of the almost impossible. Examples are legion, but there is one that we should like to cite here. Dr. F. H. Lahee, prominent geologist, told about it in discussing the oil reserves in the United States before a Senate committee. These are his words:

"It is significant that, according to Pratt's figures, the United States has discovered 44,000,000,000 barrels of oil as contrasted with a total of 37,000,000,000 barrels discovered in all the rest of the world, although the United States is estimated to have only 15 per cent of the oil-prospective territory of the world. This does not mean that our producing oil territory has more oil per unit area, but rather it is the result of American initiative and ingenuity as contrasted with the lack of incentive and the obstacles presented to exploration and development in foreign countries. It is noteworthy, according to reports, that most progress has been made in oil development in those foreign countries where the least political restrictions exist, and furthermore, that in these countries this development has been largely due to the free operation of American initiative, supported by American tools and American methods. Where the sole right of exploration and development is lodged in the Government, the bureaucratic governmental development of oil fields has not been a success. In the United States, with the encouragement which has marked our American system, we have found 54 per cent of the world's discovered oil in 15 per cent of the world's favorable oil territory. Only through continued and unhampered exercise of this same initiative can efficient development of our oil reserves be assured in the future."

And that's a truth which applies to all American industry. Let's, once again, give the green light to initiative.

CINCINNATI No. 10-66 Single Ram Hydro-Broach Machine. For complete details write for Catalog No. M-886.





Section through the ram, showing broach holder and clamping arrangement.

TWO BROACHING OPERATIONS
On This *Cincinnati* Hydro-Broach
With its Interchangeable Broach Holders

Many cases of border-line production where quantities are not large enough to keep a broaching machine busy, can be economically solved by doing more than one operation on the machine.

An example of this type is illustrated above. Both faces adjacent to the projecting lug are broached with the set of cutters shown mounted on the machine. Then the broach holders are interchanged, and the slot in the back of the part is broached. The Job was engineered by CINCINNATI or a 5-ton Single Ram Hydro-Broach Machine.

The idea works out especially well on the Hydro-Broach, because of *interchangeable broach holders* . . . located vertically from a fixed key and clamped against a solid dovetail side of the machine ram. This construction facilitates the changing of broaching tools, and assures their accurate location regardless of how often they are removed and replaced.

Perhaps may parts in your shop, including those post-war products, could be produced more economically on CINCINNATI Hydro-Broach Machines. Our engineers will be glad to figure with you.

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AUTOMOTIVE and AVIATION INDUSTRIES

Published on the 1st and 15th of the month

February 1, 1944
Vol. 90, No. 3

SAE Receives Ordnance Award

Technical Sessions and Product Display at Annual Meeting in Detroit Attended by Hundreds of Engineers

WHEN the Society of Automotive Engineers held its 1944 War Engineering-Annual Meeting during the second week of January in Detroit, from the standpoint of interest and attendance this SAE conference was the most successful in many years. More than 2200 members attended the 23 technical and business sessions scheduled over five days. Lively discussions centered on current engineering problems and developments in the automotive and aviation fields with technical papers devoted to military vehicles, passenger cars, trucks and buses, automotive transportation and maintenance, parts reclamation, airplane design, aircraft engines, Diesel engines, fuels and lubricants. Among the outstanding features were the sessions at which papers were presented on the wartime and postwar engineering uses of synthetic rubbers, plastics, aluminum, magnesium, and steel.

Major General G. M. Barnes, chief of the development branch, U. S. Army Ordnance Department, was the principal speaker and in a highly informative analysis of captured enemy materiel he reviewed many details of design and evaluated them for military service. Particular emphasis was placed on the lessons to be learned from an engineering study of enemy war equipment. Preceding his address General Barnes signally honored the SAE by presenting the society, through Mac Short, retiring president, with the Ordnance Distinguished Service Award in recognition of "outstanding and meritorious engineering advisory services in war and peace in the design, manufacture and maintenance of materiel." Through its War Engineering Board the SAE has undertaken more than 1000 projects during the past few years for the Ordnance Dept.

At the Engineering display, which is a regular feature of the Annual Meeting, Hercules Motors Corp. showed for the first time its new Diesel engine built by the D-N-X Corp. for the U. S. Navy. Waukesha exhibited the Airborne electric power plant, a specially engineered unit designed for airplanes and embodying excellent features of lightweight construction. One of the outstanding developments displayed at the meeting was a large Deepfreeze unit, produced by the Deepfreeze Div., Motor Products Corp., capable of chilling metal parts down to minus 120 F. It is understood that one of the largest of the motor car producers has adopted this unit for the installation of valve seat inserts, replacing the former methods of dry-ice or liquid air chilling. This particular unit features an automatic magazine feed for feeding inserts into the cabinet, the chilled parts emerging through a small door near the floor.

Informal discussions disclosed that automatic transmissions have an important role in war equipment, comprising variations of the General Motors Hydra-Matic, latest designs of the Banker transmission, several types pioneered by Borg-Warner, and in addition torque converters of Spicer, Twin-Disc, and others. Intensive work development also is being done in the field of gas turbines.

William S. James, chief engineer of Studebaker Corp., was elected president of the Society for 1944 and B. B. Bachman, vice president of the Autocar Co., was named treasurer, succeeding the later David Beecroft, who held that office since 1933. A. T. Colwell, vice president of Thompson Products, Inc., and SAE president in 1941, was elected a life member. Ten vice presidents, each of whom will direct a SAE activity in 1944, were elected as follows:

Aircraft—R. D. Kelly, United Air Lines Transport Corp.; Aircraft Engine—A. T. Gregory, Ranger Aircraft Engines Division, Fairchild Airplane & Engine Corp.; Diesel Engine—A. J. Blackwood, Standard Oil Development Co.; Fuels and Lubricants—J. R. Sabina,

E. I. duPont de Nemours & Co.; Passenger Car—E. H. Smith, Packard Motor Car Co.; Passenger Car Body—E. C. DeSmet, Willys-Overland Motors, Inc.; Production—J. E. Hacker, Cleveland Diesel Engine Division, General Motors; Tractor and Farm Machinery—O. R. Schoenrock, J. I. Case Co.; Transportation and Maintenance—E. W. Templin, Los Angeles Bureau of Power & Light; Truck and Bus—E. M. Schultheis, Clark Equipment Co.

Three members were elected to the SAE Council for two years: L. R. Buckendale, Timken-Detroit Axle Co.; R. F. Steeneck, Fafnir Bearing Co.; and H. T. Youngren, Oldsmobile Division, General Motors Corp. In addition, Arthur Nutt, Wright Aeronautical Corp., was elected to the Council to fill the unexpired 1943-44 term of J. C. Zeder, resigned.

Forty-eight technical papers were presented at the sessions and abstracts of a number of them are published herewith. Others will appear in early issues of AUTOMOTIVE AND AVIATION INDUSTRIES.

The Postwar Private Airplane

By William D. Hall,
Chief Engineer, Aeronca Aircraft Corp.

THE following types of private airplanes, at least, will be offered to the postwar public:

1. A low-powered, inexpensive training-type aircraft, with either tandem or side-by-side seating arrangement, which will be a refined version of the

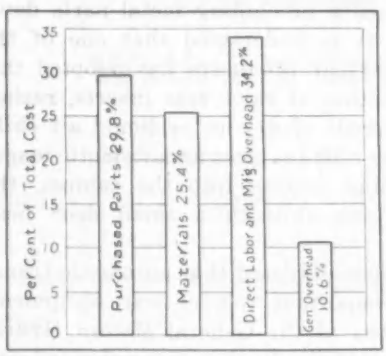


Fig. 1—Cost breakdown of typical Aeronca model.

prewar light models and will sell at approximately $1000.

2. A medium-priced, medium-performance type aircraft which will be super-safe and aimed at the private owner, and will be available in two-place models at approximately $1500 and in four or five-place models at approximately $3000.

3. An aircraft combining as high performance as consistent with reasonable safety and comfort, and costing approximately $2000. This aircraft will be a "cleaned-up" version of the prewar two-place, side-by-side, low-wing, retractible gear type and will be offered for those persons who will demand maximum performance.

When it is considered that the prices aimed at are very little higher than automobile prices, and that aircraft dealers are entitled to as good a profit margin as the automobile dealer, these prices are going to be very hard to meet with the small production of the aviation industry in comparison with the automobile industry. However, a careful study leads to the belief that these prices are not out of line. As shown in Fig. 1 for a typical Aeronca model, approximately 55.2 per cent of the airplane manufacturer's cost is beyond his control in the form of purchased equipment and material, and since this percentage is more than half the total amount allowed the manufacturer, he is handicapped at the start unless he can obtain the cooperation of his suppliers. Our postwar aircraft will be designed with the initial cost controlled as rigidly as other factors have been in the past. Further, aircraft models will be carried over from year to year, with minor changes, to amortize the high development and tooling costs, which will be necessary to start out with a reasonable price.

Design and Performance—Since we expect to have a considerably larger number of airplanes in use after the war than in the past, the visibility of the average airplane will have to be considerably improved, to prevent serious accidents. Although a few courageous manufacturers have offered the pusher type aircraft, and the aviation industry has discussed this for years as being inherently better than the conventional tractor type, a satisfactory solution of the problem from the performance and appearance standpoint has not yet been found. Since it is only with the pusher type installation that sufficient visibility will be obtained, the solution to this problem will be made in various manners, and an aircraft of this general form will be offered to the public.

Cruising speeds of 100 to 120 mph in the lower priced models will be a reality, with perhaps 120 and 140 mph cruising speeds for the higher priced models. Landing and take-off speeds of 40 to 50 mph will be necessary to allow the higher cruising speeds, unless considerable additional cost in the form of complicated high lift devices and additional power is satisfactory.

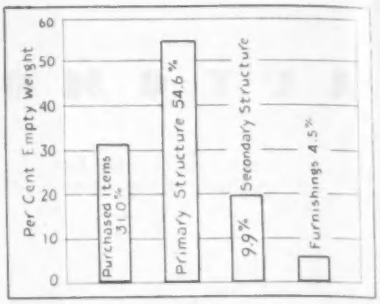


Fig. 2—Weight breakdown of typical Aeronca model.

The performance of the airplane depends a great deal on the weight of the unit, since the heavier the aircraft the more power is required to operate it,—and power is expensive. As shown in Figure 2 the airplane manufacturer is beset, in attempting to control weights, with approximately one-third of the weight empty of the airplane beyond his control in purchased items. Also, the future's aircraft will have to be more comfortable, smoother, and less noisy, and this will mean additional weight over what has been used heretofore. Therefore, in order to obtain a more efficient aircraft, more engineering work than has been done in the past will be required in developing the most efficient structures.

Aircraft Engine Inlet and Exhaust Porting

By Vincent C. Young,
Chief Engineer, Wilcox-Rich Division, Eaton Manufacturing Co.

IN THE layout of a new engine or in the revamping the performance of existing designs, the designer is confronted with the task of selecting proper port dimensions that not only fulfill performance requirements, but also result in reasonably good durability of the parts directly affected by the port. The port is here interpreted as meaning not only the port proper, but also the entrance or seating, the valve, guide and guide boss. Since these basic dimensions generally dictate the head design they should be known at the inception of the layout. Much depends on the choice of proper dimensions at the seating end, so that if some basic constant could be established, determined

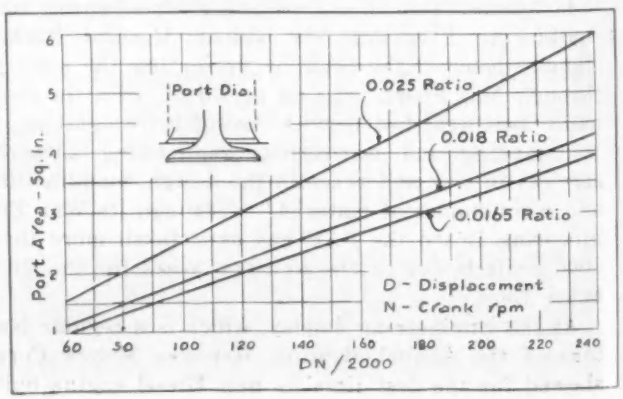


Fig. 3—Port area, as a function of DN/2000 obtained by plotting data from a number of engines.

from actual performance data, this phase of the problem should be simplified.

Fig. 3, which shows the port areas as a function of the quantity DN/2000, was obtained by plotting the data of a number of representative engines. The port area is based on the small diameter of the cylinder seat as shown in the sketch. No allowance is made for stem diameter, since a study of existing engines with varying stem diameters indicates little or no effect on the flow.

It is found that a line having a slope of 0.025 passes through the field of inlet ports without too much scatter. A second line with a slope of 0.018 takes in the majority of the exhaust ports, while a third line with a slope of 0.0165 might be termed a safe low limit slope for exhaust ports, being based on actual engine data where smaller than average ports have been tested with no appreciable effect on performance. By use of these data the basic dimensions of inlet and exhaust ports may be determined, knowing only displacement and speed.

A study of engines within the range of conventional design, with bore-stroke ratios varying from 0.792 to 1.12, indicates no bearing of this variable on the data presented. Furthermore, no attention was given to segregating engines into groups such as high-speed and low-speed, naturally aspirated or supercharged.

Single Plunger Injection Pump

By Raymon Bowers and R. E. Peterson,
International Harvester Co.

TODAY injection equipment is available to cover any normal demands, but at the time the International Harvester Co. first considered the manufacture of Diesel engines that was not the case. Therefore, almost of necessity, both injection system and the engine were developed together; and when production was started, the necessary buildings, machine tools and personnel were provided for the manufacture of the injection equipment as well as of the engines.

While this single plunger injection pump was developed for use on a four-cylinder, four-cycle, precup-type engines having relatively small displacement and operating up to 1800 rpm, the single plunger principle is not necessarily limited to four-cylinder engines, but could be used on any similar multi-cylinder engine providing the maximum number of injection strokes per minute were not beyond the practical limitations of a single plunger. Tests have shown that it meters satisfactorily up to 3000 rpm engine speed. This pump is flange-mounted on the crankcase front cover, is completely enclosed and is driven by a gear on the pump camshaft. A single plunger meters and delivers all the fuel to the engine through a distributing system consisting of four cam-operated distributor valves. The manner in which the fuel is metered and delivered is basically the same as in the conventional multi-plunger pump except the single plunger delivers all the fuel. The governing is controlled by a flyball governor through a simple linkage which rotates the plunger in its barrel. The plunger unit, the distributor unit, the primary and scavenging pump assembly, and the mounting flange by which the pump is attached to the engine, and in which the camshaft and governor shaft gears are enclosed, are all mounted on the pump housing. The camshaft, governor shaft, governor fork shaft, distributor valve tappets and other essential parts are installed within the pump housing.

The plunger unit (see Fig. 4) includes a single conventional helical grooved plunger, operated in a two-port plunger barrel by an eccentric on the end of the governor shaft, a check and reverse check valve above the plunger, a by-pass valve on the primary fuel side and other parts to make it a complete assembly. This unit is located at the top of the pump housing.

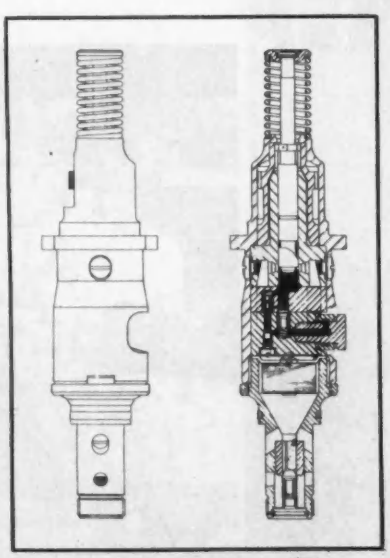


Fig. 4—Plunger unit of IHC injection pump.

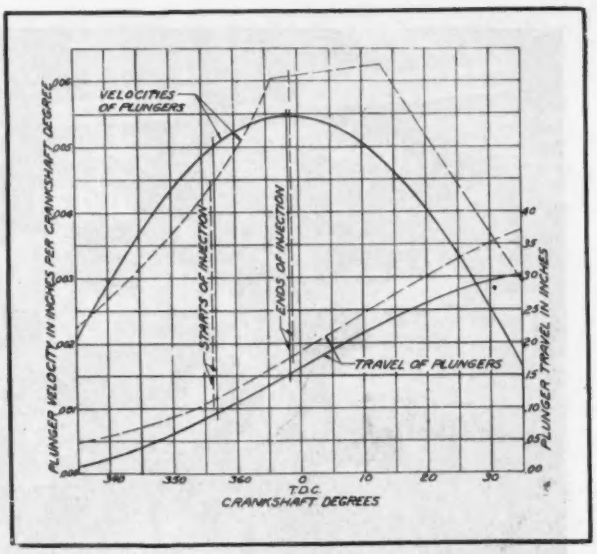


Fig. 5 — Plunger velocity and travel curves of IHC single plunger pump (solid lines) and a conventional pump (dashed lines) of multi-plunger type.

Although this plunger does the work of the four plungers in the conventional type injection pump, it does not operate four times as fast. (See plunger velocity diagram, Fig. 5.) The main difference between the plunger action in the single and multi-plunger type

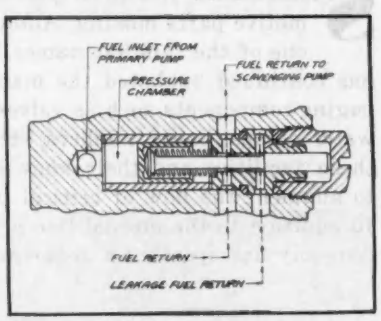


Fig. 6—Scavenging valve assembly.

pumps is that the single plunger is going up and down continuously, whereas in the other case those plungers not delivering fuel remain motionless on the heels of their respective cams. It should also be pointed out that the simple armonic motion obtained with an eccentric is less severe on the plunger and plunger return spring than is the cam action of the conventional pump. Factual proof of this is substantiated by the fact that breakage of plunger return springs on the single plunger pump is unknown, despite the fact that this spring does the work of four springs in a multi-plunger pump. Injection pressures range between 2000 and 4000 psi and the nozzles are set to open at 700 psi. The instant injection ends the reverse check valve drops this pressure to approximately 600 psi, which eliminates dribbling of fuel after injection ends.

The distributor valve block assembly holds the four valves which distribute the fuel to the various cylinders. This unit is assembled on the top of the pump housing, in front of the plunger

(*Turn to page 78, please*)

(Right) One gallery in the aluminum foundry features an array of sixteen 450-pound gas-fired, tilting type melting pots.

(Left) Inspection of precision-made aluminum and magnesium castings is a painstaking operation. Here is one corner of the inspection department. Note the operator at the extreme right using a form template for checking contour. Similarly the man in the foreground and the one in the center are checking castings dimensionally. Good gages are the backbone of good castings in this operation.

Flexibility

SYMBOLIZING the principles of independent automotive parts making, Aluminum Industries, Inc., one of the familiar names in the parts business, has continued unabated the manufacture of essential engine components such as valves, pistons, piston pins, water pumps, liners, mufflers, etc. The availability of these facilities and their know-how have done much to augment the flow of critical parts during the war. In addition to the normal line of parts production the company has operated a department for the manufacture of 20 mm armor piercing shot; and has been turning out tank track pins in large volume.

However, the most significant advance made by Aluminum Industries is the establishment of one of the finest aluminum and magnesium foundries to be found in the industry. This foundry was placed in operation in 1941 before our entry into the war and was built and equipped at the company's own expense. Unquestionably this foundry is one of the most flexible in existence for the production of castings for aircraft. The aluminum foundry alone runs the gamut of some 26 different alloys, turns out something like 600 different patterns in all sizes. Anyone familiar with foundry management can appreciate the

is Basic Characteristic

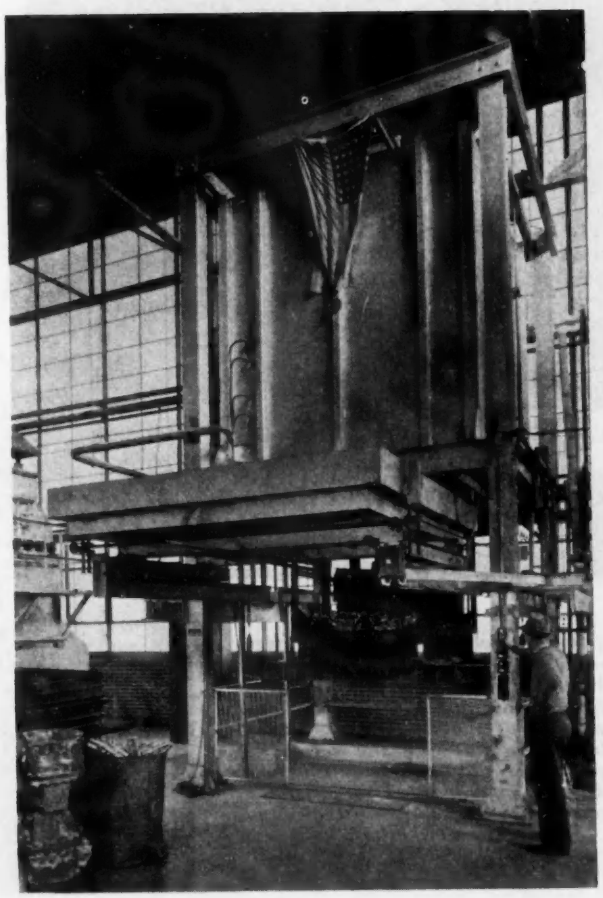
of Aluminum Industries Operations

This is the Ninetieth in the series of monthly production features

By Joseph Geschelin

task of producing large tonnages of such a wide variety of castings.

Still another by-product of the past few years is the addition of an important paint plant. This handles not only a complete line of ready-mixed aluminum paints for product finishing and general painting, but also a diversity of Government specification finishes. The paint activity marks an important development for post-war business. All of the products of Aluminum Industries, Inc., including automotive parts for original equipment and replacement, aluminum and mag-



(Extreme left) Looking down a molding bay in the aluminum foundry. Here are the molding stations, served by the Jeffrey sand distributing system overhead.

(Immediate left) Permite aluminum pistons are produced in the permanent mold department of the foundry. Here is a glimpse of the final inspection of piston castings before they are released to the machine shop.

(Right) Most impressive piece of equipment in the foundry is this huge General Electric elevator type annealing furnace with quench tank below.

nesium castings and the various aluminum paints and industrial finishes, are manufactured and marketed over the brand name—Permite Products.

Generally speaking, the manufacturing setup has remained unchanged save for the addition of new items of equipment here and there. Since flexibility is the basic characteristic of the operation, the production machinery is conventional and features general purpose equipment coupled with quickly interchangeable tooling and fixtures. The importance of flexibility may be gaged from the fact that this organization is set up to produce original equipment parts for new vehicle models and replacement parts for everything that rolls and for practically every model of passenger car and truck that has been built in recent years.

Here are a few examples of what flexibility means in this plant. At any given time they run from 8 to 10 different types of cast iron pistons. At the same time they will run around 25 different types of aluminum pistons. The valve department handles something over 150 different intake and exhaust valves, the latter being of bimetal construction. The water pump department produces a complete line of pumps of every variety. Another small department supplies a complete line of cylinder sleeves. In addition, they produce aluminum connecting rods for certain small engines and outboards. These rods are permanent mold castings which require only minor machining operations by the engine builder.

(Above) Valve tips are flame-hardened with the oxy-acetylene torch. In the setup shown, it is necessary to hold the length of the hardened portion of the tip to a prescribed limit. To this end the valves are placed in the tank with the head down and tank filled with water at the proper level to control the depth of hardening.

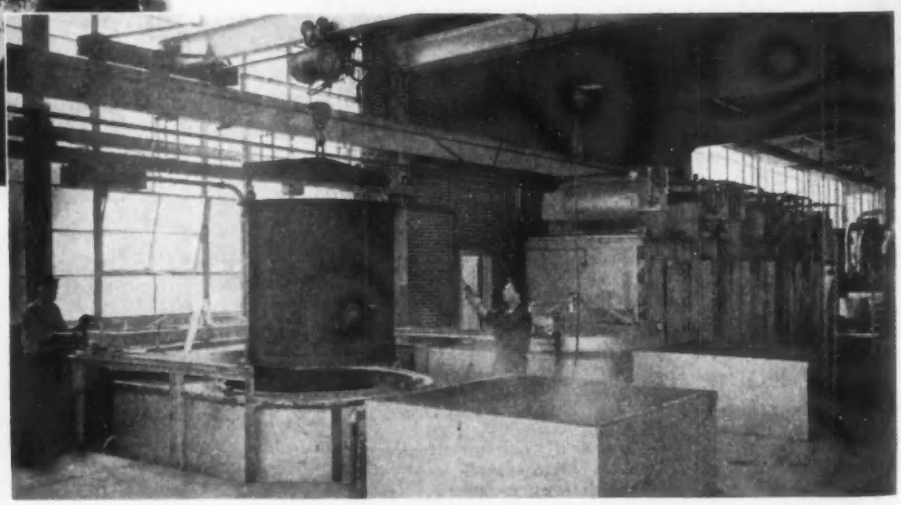
An interesting aspect of machine shop operations is the fact that all metal cutting is done with cemented carbide tools, principally carboloy and Kennametal in various grades. In fact, the only exception to this practice is found on screw machines. The use of Carboloy and Kennametal is responsible for tangible cost economies, for speed of metal removal, and for fine surface finish.

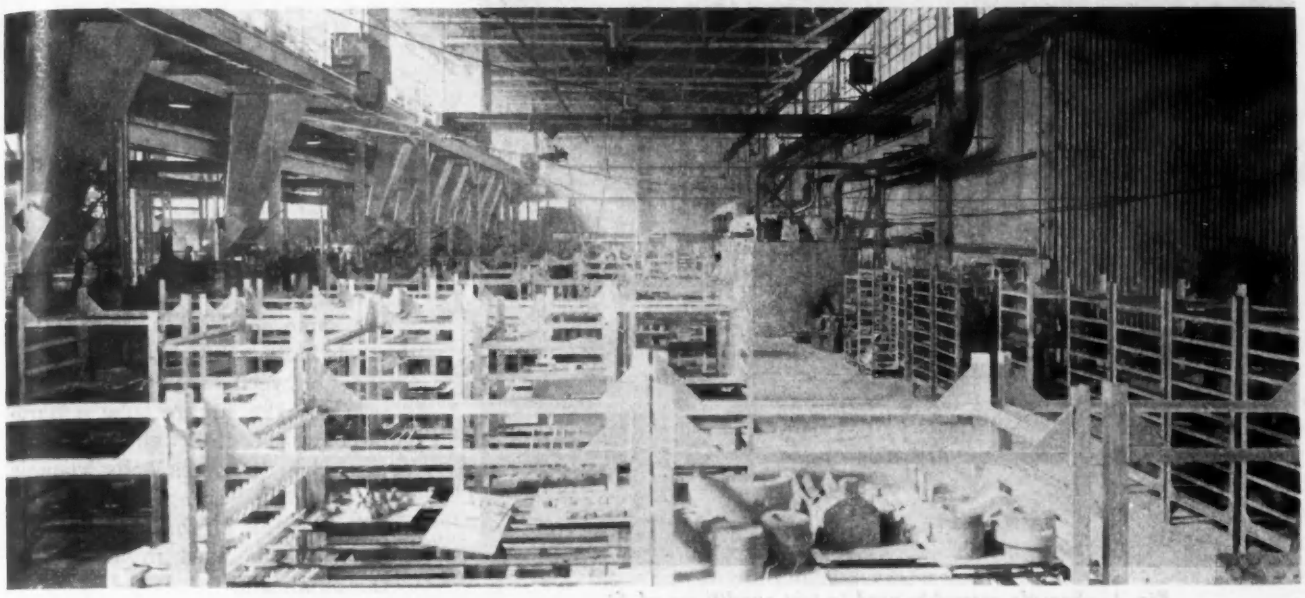
Among the equipment in the machine shops are familiar items such as the following: a large battery of Cincinnati Centerless grinders; Cincinnati Centerless lapping machines; Norton cam grinders for pistons; Heald Bore-Matics for piston pin bores; Sundstrand stub lathes; National Acme-Gridley automatics; Gisholt turret lathes in the water pump department; Cincinnati and Landis angular head collet grinders for valve seats.

Now for a few examples of how Aluminum Industries makes parts. Consider a typical exhaust valve. It starts with bar stock—2112 alloy for the head and 3150 alloy steel for the hardenable tip. The bar stock is sheared to correct lengths, washed in preparation for welding, then welded into a single piece in one of a battery of Taylor-Winfield butt welding machines. The flash is removed by turning in a lathe. The bar is heated in a furnace and upset in one of several upsetting machines. The upset end then is coined to the proper head form in a Bliss mechanical press. The head is drawn in an annealing furnace, the stem straightened axially with the head in a Waterbury-Farrel thread-rolling machine which was converted to a roll straightener.

The valve is now ready for machining. First operation is that of rough grinding the stem in a Cincinnati Centerless grinder. Turning of the land, cutting to length, chamfering and grooving of the tip are done in two operations on Warner & Swasey turret lathes. The end of the tip is ground in a special end grinding machine, then the tip is hardened with an oxy-acetylene torch. On some valves where the

(Below) Corner of the heat treating department in the foundry. In the foreground are two Despatch pot-type solution heat treating and annealing furnaces.



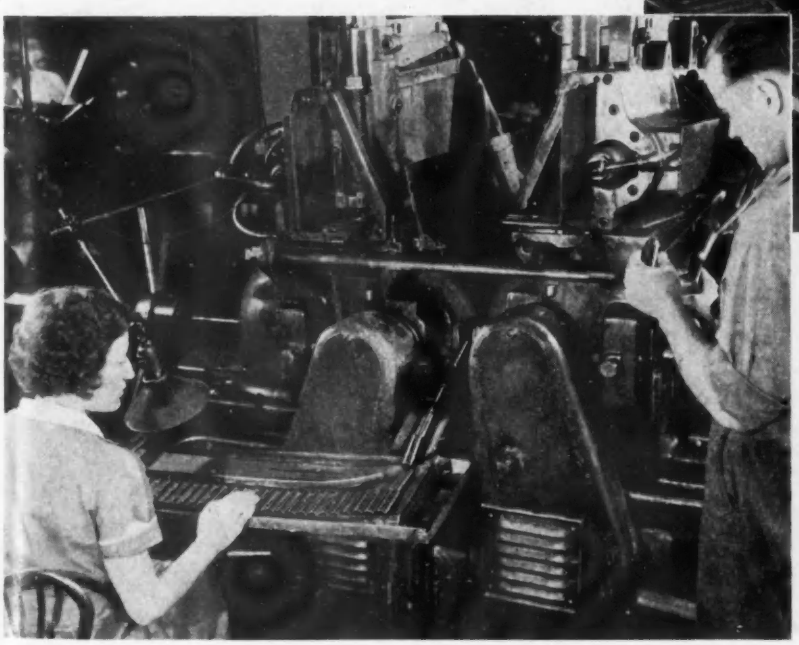


A view in the aluminum sand core department with core racks in the foreground. At the left is the sand distributing belt and the hoppers which form a part of the Jeffrey sand conveyor and distributing system. In the background at the right are Despatch and Gehnrich core baking ovens.

hardened section must be held to a definite short length, the torch hardening is done while the valves are immersed in a water tank with the tip protruding the proper amount above the water level.

The stem is semi-finish ground on a Cincinnati Centerless, the tip is polished to remove hardening scale and discoloration, and the valve head seat is rough ground in a Cincinnati centerless seat grinder. The latter is a special adaptation of a centerless grinder with an angular wheel head attachment. The head is burred, the stem is semi-finish ground for cor-

(*Turn to page* 58, *please*)



(Above) Portion of the aluminum pouring line. The molds, as shown, are moved along on the gravity roller conveyor.

(Left) One of many Cincinnati Centerless Lapping machines found in the Permite plant, this one is putting the mirror-finish on ground piston pins.

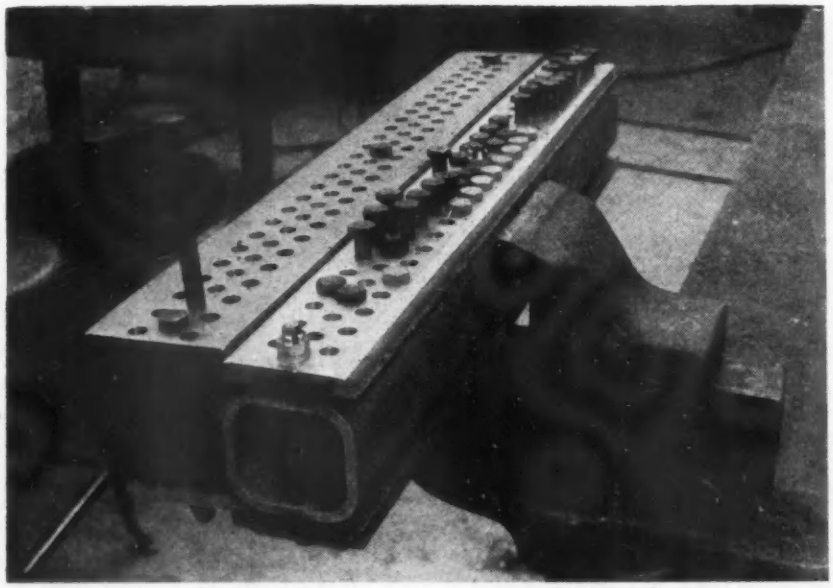


Fig. 1—Sample assembly used to test conditions of fit

By
Charles C. Colvin

Production Design Engineer,
Lockheed Aircraft Corp.

SOME difficulty having been experienced in obtaining the light drive fits of steel and duralumin bolts specified for certain aircraft assemblies, an investigation was instituted and showed that a considerable proportion of the bolts were outside the specified limits. The Inspection Department checked the bolts by quality control methods, to determine the probability tolerance limits on bolts of various sizes. Tests were made on 150 NAS-56-44 steel and duralumin bolts, both with a nominal diameter of 0.3742 in. Six readings were taken along the shanks of the bolts with a Passover visual precision gage, and the bolts were divided into groups differing by 0.0001 in. in diameter.

To determine the pressure required to drive bolts in assembly operations, a sample assembly to represent the joint on an airplane bulkhead was made up, as shown in Fig. 1. The assembly included a piece of extruded angle, a piece of extruded channel, a length of square tube, one piece of No. 4340 steel 7/16 in. thick, and another piece of the same steel ¼ in. thick. The steel bars were heat-treated to show between 150,000 and 170,000 psi; for the square tube a hardness of 41C Rockwell was specified (which corresponds roughly to a tensile strength of 191,000 psi), and all of the material was the same as used in assembling the bulkhead.

As part of the project it was decided to determine the proper drill sizes and tolerances, and also the proper reamer sizes for rough-and-finish-reaming holes for the bolts above mentioned in heat-treated X4130 steel and 24ST aluminum. Twelve new NAS reamers as used by outlaying plants were brought in, and were inspected and tested by reaming the holes for typical joints. One hundred reamers as received

Table I

Pressures Required to Drive Bolts Varying in Diameter by One Ten-Thousandth Inch. (All holes gaged .3735 in. dia.)

NAS Steel Bolt Diameter (In.)	Pressure thru Top Hole (Lb.)	Pressure thru Bottom Hole (Lb.)
.3742	550	1300
.3741	300	600
.3740	200	790
.3739	120	440
.3738	310	410
.3737	85	210
.3736	Push	130
NAS Dural Bolt Diameter (In.)		
.3742	300	750
.3741	250	525
.3740	150	700
.3739	150	400
.3738	60	120
.3737	30	85
.3736	Push	50

Table II

Reamer Sizes for NAS Bolts

	Bolt	Bolt Limit	Finish Reamer Limit	Finish Pilot Limit	Drilled Hole Size	Rough Reamer Limit	Rough Pilot Limit
(A)							
NAS 53	.1894	.1888	.1889	.171	.1719 +.003 −.000		
NAS 54	.2492	.2486	.2487	.169			
NAS 55	.3117	.3111	.3112	.237	.2187 +.003 −.000		
NAS 56	.3742	.3736	.3737	.235		.260	.217
NAS 57	.4367	.4361	.4362	.298	.2812 +.003 −.000	.238	.215
(B)				.296		.301	.280
NAS 53	.1888	.1882	.1883	.361	.3437 +.003 −.000	.299	.278
NAS 54	.2486	.2480	.2481	.359		.364	.342
NAS 55	.3111	.3105	.3106	.423	.4062 +.003 −.000	.362	.340
NAS 56	.3736	.3730	.3731	.421		.426	.405
NAS 57	.4361	.4355	.4356	.171	.1719 +.003 −.000	.424	.403
			.4354	.169			
				.237	.2187 +.003 −.000		
				.235		.240	.217
				.298	.2812 +.003 −.000	.238	.215
				.296		.301	.280
				.361	.3437 +.003 −.000	.299	.278
				.359		.364	.342
				.423	.4062 +.003 −.000	.362	.340
				.421		.426	.405
						.424	.403

NOTE: Bolt limits in (A) for steel bolts

Bolt limits in (A) + (B) for Dural bolts (NAS 54 — .2492"-.2480")

For grading, low limit of Dural bolts in Group A shall have a low limit .0001" greater than shown in table, i.e. NAS 56, Group (A) will be .3742 — .3737.

Requirements to be met to obtain

Light Drive Fits

at the plant for resharpening were checked for diameter. Tests of these two sets of reamers showed that they would not produce holes giving the required light drive fit. It was therefore decided to make new reamers. Four blanks were selected and new reamers made from them, which were ground to a tolerance of 0.0002 in. on the circle diameter, and 0.002 in. on the pilots. Two of these were made to serve as roughing reamers to remove a maximum of 0.020 in. material, the other two as finish reamers, to remove a maximum of 0.010 in material. The diameter of the finish reamer was set so that the high limit was 0.0001 in. below the low limit of the NAS bolt. Dimensions of the finish reamer are given in Tabe II.

In performing the reaming operations, a portable air drill was used, and operated at 200 rpm. Reamer fluid of SAE No. 10 viscosity was applied with a brush. The holes were reamed in the sample assembly with the new reamers ground to the low limit established in Table II. Thus the holes were 0.0007 in. below the nominal bolt diameter, or 0.0001 in. smaller than the smallest bolts supplied by the Inspection Department. In the case of the NAS 56 bolts used, the smallest bolt measured 0.3736 in. in diameter. Owing to the fact that the bolts were in an assembly of hard steel and aluminum, there was a misalignment through the box tube. Ordinarily, a bolt of the size mentioned above could be pushed in easily, but in this case, owing to the misalignment, a light tap with a 6-oz hammer was necessary to drive the bolt through. Fifty bolts, including both steel and duralumin, of diameters varying by 0.0001 in. up to the nominal size, were then driven in with the 6-oz hammer.

Another set of bolts, also varying by 0.0001 in. in diameter, were then driven into other holes, previously gaged on the Baldwin-Southwark tensile machine. This test was run to determine the

(*Turn to page 90, please*)

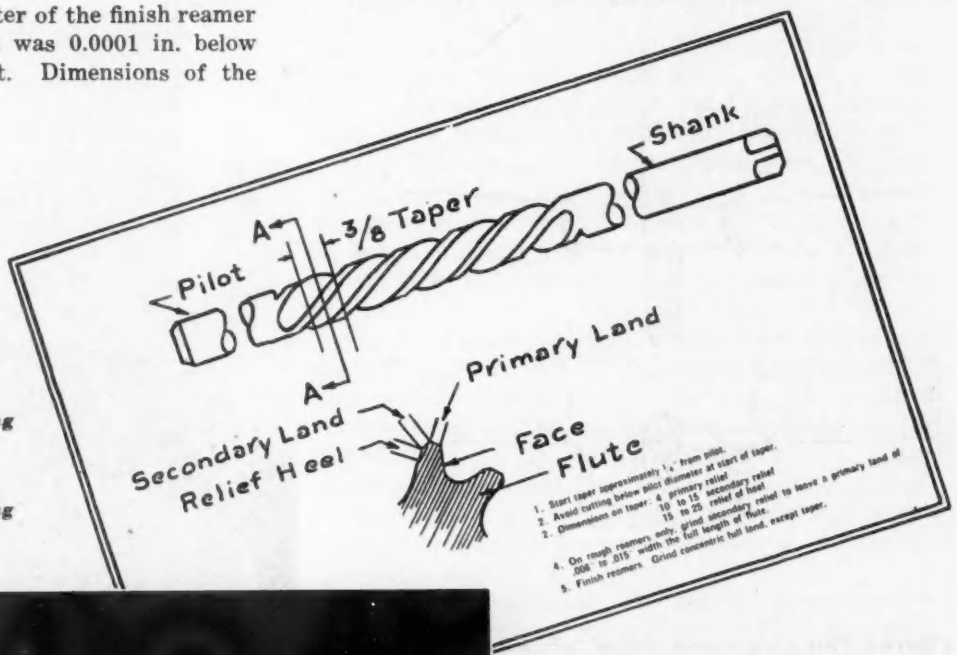

Shank
3/8 Taper
A
Pilot
A
Primary Land
Secondary Land
Relief Heel
Face
Flute
1. Start taper approximately ¼" from pilot.
2. Avoid cutting below pilot diameter at start of taper.
3. Dimensions on taper: 4 primary relief
10 to 15 secondary relief
15 to 20 relief of heel
4. On rough reamers only, grind secondary relief to leave a primary land of .006 to .015" width the full length of flute.
5. Finish reamers. Grind concentric full land, except taper.

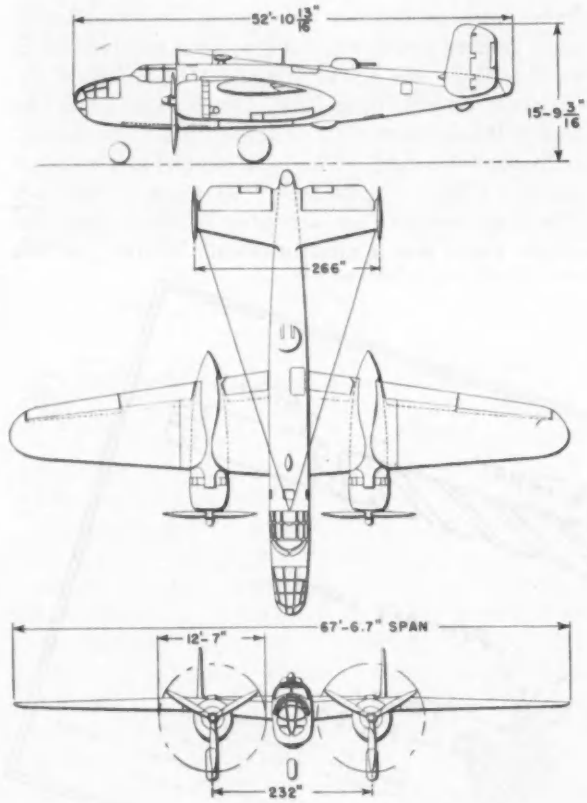
Fig. 2—Instructions for grinding reamers for bolt holes

Fig. 3—Typical set-up for grinding tapers on reamers

North America's

B-25C and D Bomber

B-25C medium bomber of the U. S. Army Air Forces.

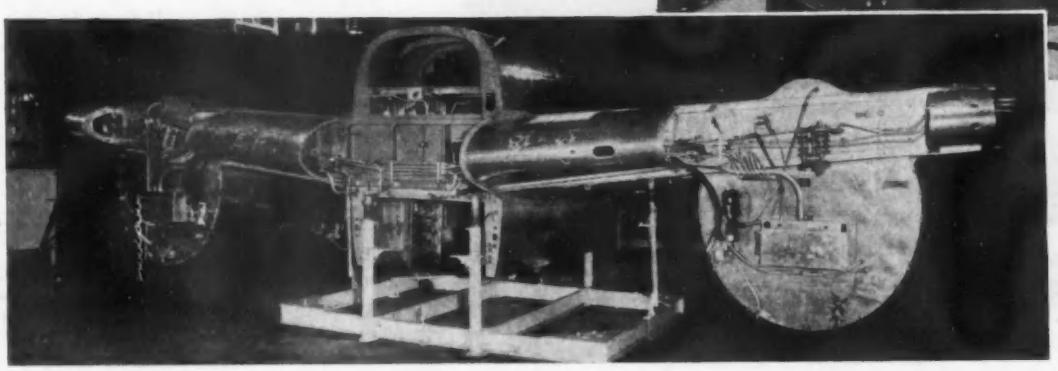


NORTH AMERICAN AVIATION was awarded a contract for the B-25 Mitchell medium bomber Sept. 20, 1939, and a completed bomber structure was ready on July 4, 1940 for static test at Wright Field. The first B-25 was test flown on Aug. 19, 1940. It required 8500 original drawings involving expenditure of 195,000 engineering man-hours. Since that time more than 11,000 drawings have been devoted to improving the bomber, requiring in excess of half a million engineering man-hours, to keep up with revolutionary advances in air-war science.

Ease and rapidity of construction and repair were one of the dominating features in the airplane's design. The structure was divided into 48 major, separ-

(Below) This wing center section, which is also the center section of the B-25 fuselage, has been removed from the moving assembly line and placed on a cradle so that it could be photographed alone.

Next to be added is the forward section and then the nose section. The assembly is then rolled onto an overhead turntable and elevator, where the engines are attached. As soon as it is turned around, the assembly is lowered onto a castered cradle and is rolled out from under the turntable so that the after section may be attached, just as it reaches the final assembly line.



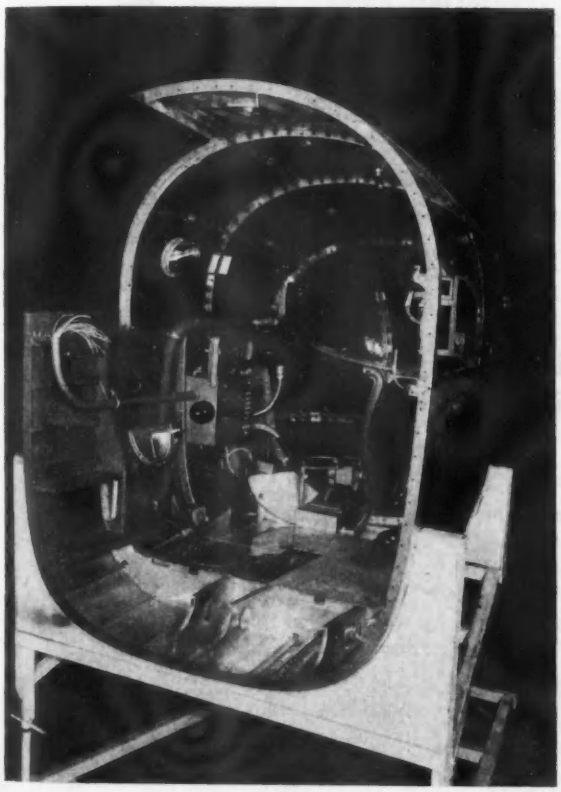
(Above) This photograph of the bulkhead forward of a B-25 cockpit shows the crawlway beneath the pilot's seat through which bombardier can reach compartment of pilot and co-pilot.

Part One

Part Two will appear in an early issue

By N. S. Houston
Assistant Chief Engineer,
North American Aviation, Inc.

(Right) This recent model of the B-25 bomber has a shorter nose section of all metal construction. Nose armament includes a 75 mm. cannon and two .50 caliber machine guns.



B-25 nose section with various installations under way.

able components, contracts for which could be divided among more than 900 suppliers and sub-contractors.

In the models that have followed, changes in range and armament have been made in response to the constantly shifting tactical requirements of such an airplane. The original B-25 had three waist gun positions, but no top turret, and the armament was .30 caliber machine guns, with the exception of a .50 caliber machine gun in the oil. One flexible .30 caliber gun that could be used in three positions was installed in the nose.

Next change in armament was to take out the three waist guns and the tail gun and install upper and lower power-driven Bendix turrets, which afforded protection to the rear as well as sides, since there was adequate view between the twin tail structure. Both turrets were equipped with .50 caliber guns, although the .30 caliber gun was retained in the nose. Decision was made soon afterward to adopt the .50 caliber gun as standard and a fixed .50 caliber gun was installed in the nose and also a flexible gun, making two in the nose.

During the latter part of 1940 self-sealing gasoline tanks were installed, and more armor plate was added from time to time for protection of the pilot. The last major change announced by North American is the installation of a 75 mm cannon and two .50 caliber machine guns in the nose, which necessitated the installation of a shorter all-metal nose to replace the former "greenhouse" type as shown in the accompanying photographs.

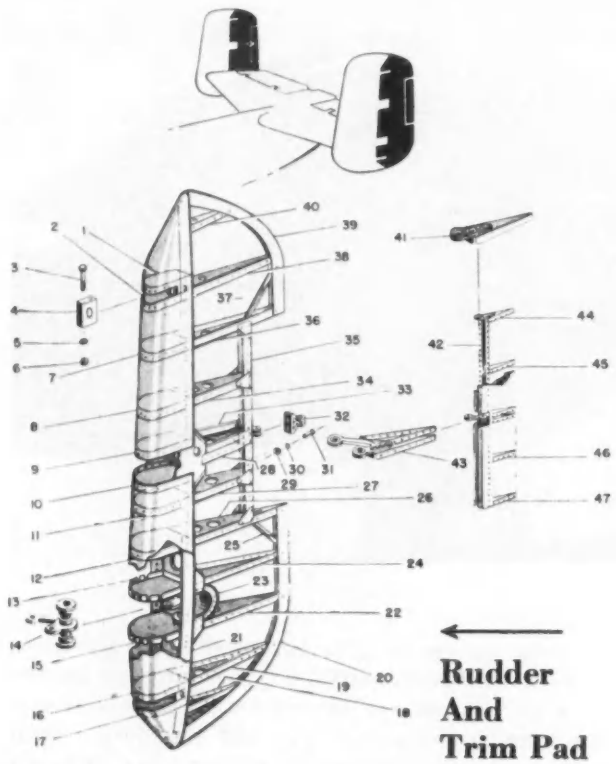
The B-25 in combat is a twin-tail, high-speed, midwing land monoplane, powered by two 1700 hp Wright Cyclone, supercharged 14-cylinder, twin-row, air-cooled radial engines, driving 12 ft 7 in. full-feathering, constant-speed Hamilton Standard hydromatic three-blade propellers. It can carry about 5000 pounds of bombs, including torpedoes or depth charges, six .50 caliber machine guns with 2400 rounds of ammunition, and a crew of pilot, co-pilot, bombardier, radio operator and gunner, at a speed in excess of 300 miles an hour for long distances. For fly-away delivery to war zones, using droppable tanks, its range exceeds 3000 miles. Its weight empty is 20,305 pounds, normal gross weight 27,051 pounds, useful load 6750 pounds.

Wings

The full cantilever, stressed skin wings, consist of a center section (integral with the fuselage), and two removable single-spar outer panels, with detachable tips. The center section wings carry the power plants with their nacelles, the self-sealing fuel and oil tanks and such additional equipment as oxygen bottles and fire extinguishers. The center section is a strong, rigid struc-

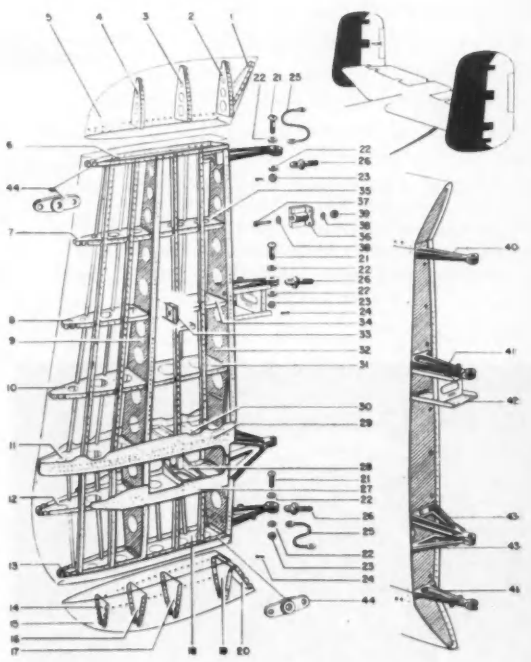
ture built on two heavy, reinforced, full-length spars.

The wing outer panel, including the aileron and large oil cooler assembly at the inboard end, weighs 560 pounds, has a maximum chord of about eight



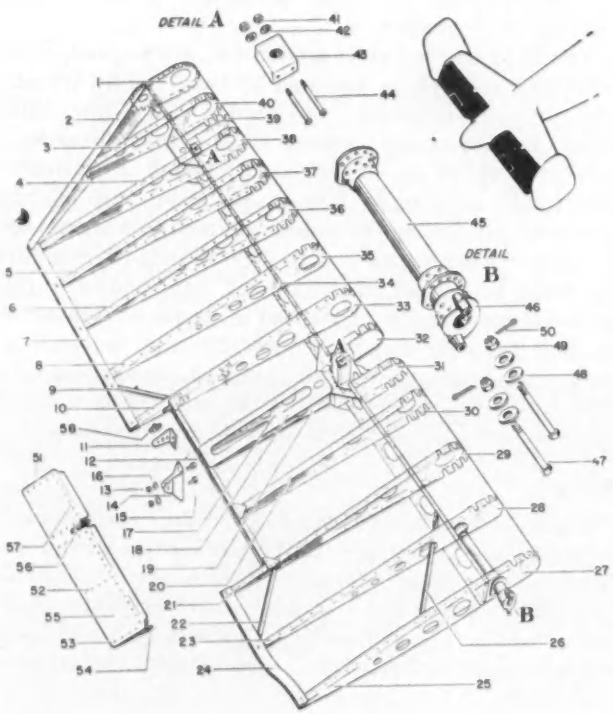
Rudder And Trim Pad

1-2 Rib
3 Bolt
4 Block
5 Washer
6 Nut
7-8-9-10-11-12-13 Rib
14 Tube Assem.
15 to 19 Rib
20 Edge
21 Beam Assem.
22 Rib
23 Support
24 Rib
25 Tube
26-27 Rib
28 Channel
29 Nut
30 Washer
31 Bolt
32 Bracket
33-34 Rib
35 Beam
36 Rib
37 Tube
38 Rib
39 Edge
40 Rib
41 Hinge Assem.
42 Beam
43 Horn Assem.
44-45 Rib



Vertical Stabilizer

1-2-3-4 Beam
5 Tip
6-7-8 Rib
9 Beam
10-11-12-13 Rib
14 Beam
15 Tip
16-17 Beam
19-20 Beam
21 Bolt
22 Washer
23 Nut
24 Pin
25 Bonding
26 Eyebolt
27 Doubler
28 Support
29 Doubler
30-31 Rib
32 Beam
33 Fitting
34-35 Rib
36 Fitting
37 Bolt
38 Washer
39 Nut
40-41 Bracket
42 Rib
43 Bracket
44 Nutplate



Elevator and Trim Tab Assembly

1 Rib
2 Edge
3-4-5-6 Rib
7 Edge
8 Rib
9 Tube
10 Rib
11 Bracket
12 Beam
13 Nut
14 Bracket
15 Bolt
16 Washer
17 Rib
18 Plate
19 Channel
20-21 Rib
22 Tube
23 Rib
24 Edge
25 Rib
26 Tube
27-28-29-30-31-32-33 Rib
34 Beam
35-36-37-38-39-40 Rib
41 Nut
42 Washer
43 Block
44 Bolt
45 Tube
46 Coupling
47 Bolt
48 Washer
49 Nut
50 Pin
51-52-53 Rib
54 Hinge
55 Tab
56 Horn
57 Beam
58 Nutplate

feet, is approximately 20 feet long, excluding the detachable tip. This structure is of 24ST aluminum alloy extrusions and Alclad sheet, consisting of spars, hydro-press formed ribs and skin stiffened in a spanwise direction by stringers. The total wing span is 67 ft, 6.7 in., and the wing area is approximately 610 sq ft.

Sealed-type ailerons, each 11 ft 7 in. long, have combination booster and controllable trim tabs, are operated by control wheels in the pilot's enclosure with cables that lead out of the torque tube on each side of the airplane to the aileron sector on each rear wing spar. A cable movement of 3½ in. will move one aileron up 30 deg and the other down 15 deg. Controls in one wing can be shot away without affecting the controls in the other wing.

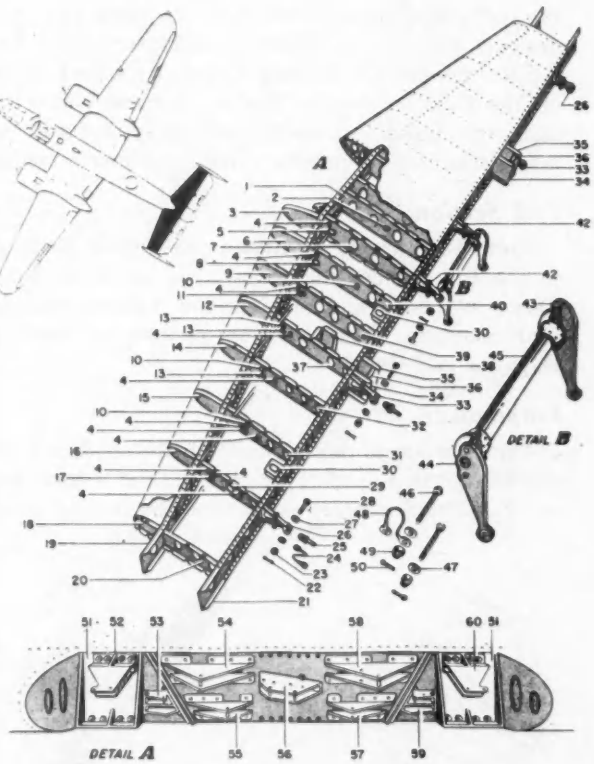
Slotted type, trailing edge flaps on each wing (15 ft long) in two sections on each side of the engine nacelles, are operated by hydraulic struts in the nacelles connected to torque tubes, or in an emergency, by hand cranking.

Fuselage

The fuselage is a semi-monocoque, all-metal, four-longeron stressed skin structure, 53 ft long, consisting of three main sections: front, center and rear, The forward section contains the bombardier's "greenhouse," and the compartments for pilots and navigator. The intermediate section (built integral with the wing center section) consists of the bomb bay with hydraulically-operated doors. The rear section contains the radio and gun turret stations, and the lie-down observation post in the transparent tail cone. Passageways under the pilot's compartment and over the bomb bay provide interchangeability of crew members. Two main entrance hatches are in the navigator's and the photographer's compartments. Emergency exit hatches are provided at the stations of bombardier, pilot and photographer.

Bombardier's Station

Starting at the nose of the ship there is the Plexiglas (or Lucite) enclosed bombardier's compartment equipped with bomb controls, bombsight and two .50 calibre machine guns, one fixed and

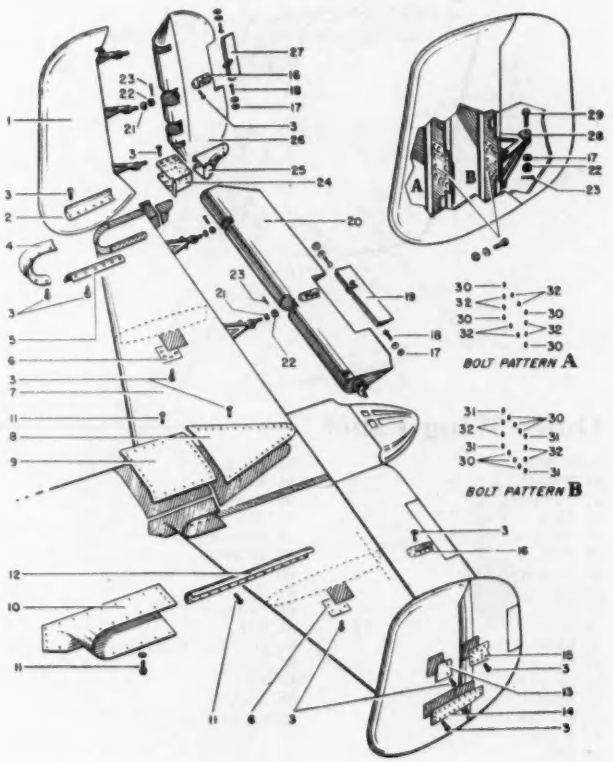


Horizontal Stabilizer

1 Rib
2 Fairlead
3 Rib
4-5 Fairlead
6-7 Rib
8 Fairlead
9 Rib
10-11 Fairlead
12 Rib
13 Fairlead
14-15-16 Rib
17 Fairlead
18 Rib
19 Beam
20 Rib
21 Beam
22 Pin
23 Nut
24 Pigtail
25 Eyebolt
26 Bracket
27 Washer
28 Bolt
29 Rib
30 Doubler
31-32 Rib
33 Bracket
34-35 Rib
36 Plate
37 Rib
38 Bracket
39-40 Rib
41 Bolt
42 Bracket
43-44 Horn
45 Tube
46 Bolt
47 Washer
48 Pigtail
49 Nut
50 Pin
51 Fitting
52 to 60 Bracket

Installation Empennage

1. Vertical stabilizer
6. Elevator drum access door
7. Horizontal stabilizer
19. Elevator tab
20. Elevator
26. Rudder
27. Rudder tab
28. Rudder main hinge bracket



the other flexible in a centered ball-and-socket joint. Aft of the bombardier's station, accessible for the bombardier through a lower crawlway, is the cockpit for the pilot and co-pilot.

Navigator's Station

A curtain covers the opening from the cockpit into the navigator's compartment behind the pilot. Here is a navigator's chart table with protractor, the drift sight, and astro-compass. The drift sight consists of a telescopic sight, with controls for measuring the drift of the plane in relation to the path of flight. Twelve drift signals of both day and night type are available.

In it are the astro-dome and astro-compass for obtaining the true bearing of distant objects. With it the navigator can compare the theoretical route with the actual. The astrograph projects the corresponding celestial maps on the chart table, which is equipped with special plotting paper and drafting machine for laying out an accurate course. The remote reading compass transmitter in the outer wing panel, away from magnetic interference, transmits its data to dials in front of the pilot, bombardier, and navigator.

Radio Operator's Compartment

Just aft of the bomb bay and inter-connected to the navigator's compartment by the bomb bay crawl deck is the radio operator's compartment. This section houses the liaison radio equipment in use on the B-25 bombers. The compartment also contains the upper and lower power-operated gun turrets, scanning windows and emergency escape

Tail Section

From the turrets an armor plate door leads aft to the tail compartment and rear entrance hatch. There are floor and side-window camera settings (for charting, night, motion picture and vertical mapping cameras).

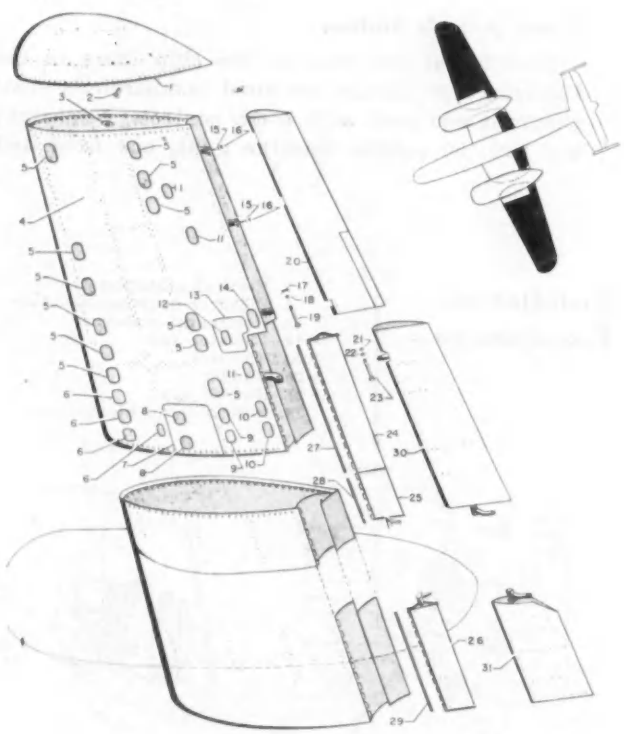
Empennage

The semi-monocoque, full-cantilever horizontal stabilizer has a span of 22 ft 2 in. and a total area of 92 sq ft. Stabilizer spars are continuous across

Outer Wing Complete

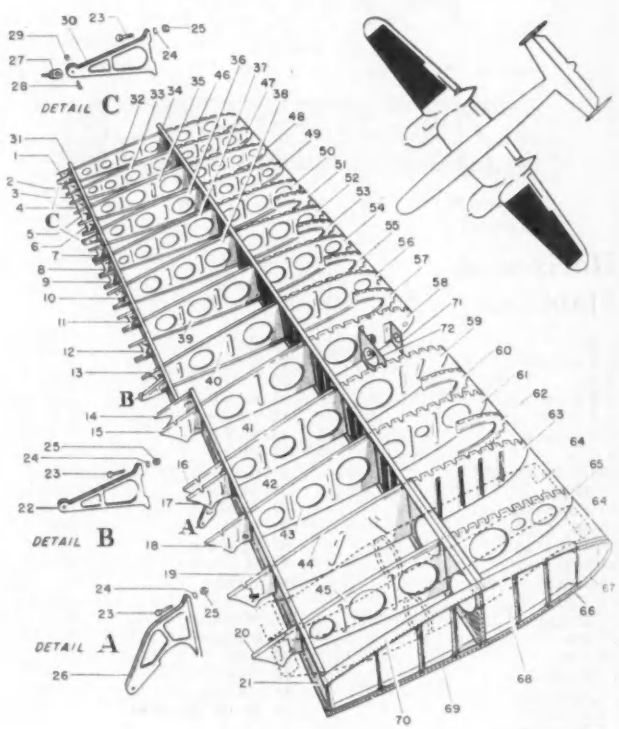
Bottom View

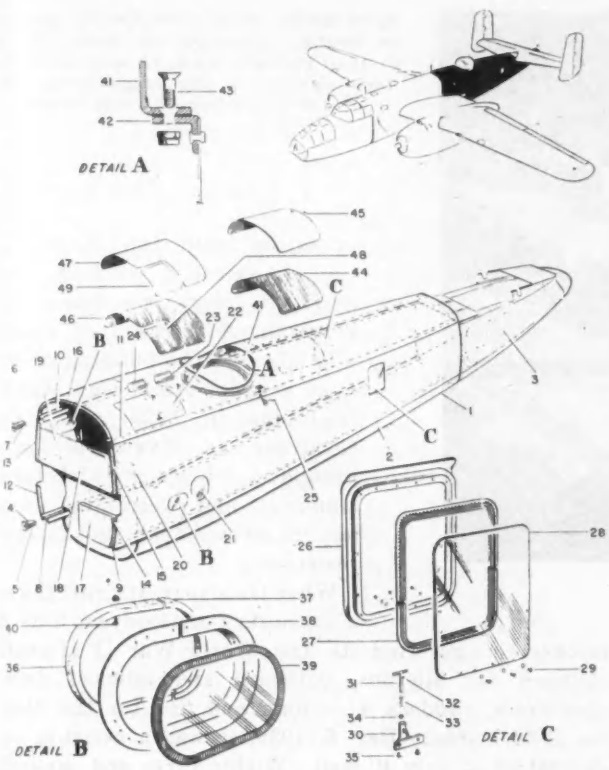
1 Tip
2 Screw
3 Nutplate
4 Wing
5-6 Cover
7-8-9-10 Door
11 Cover
12 Door
13-14 Cover
15 Bushing
16 Nut
17 Pin
18 Nut
19 Bolt
20 Aileron
21 Nut
22 Washer
23 Bolt
24-25-26 Door
27-28-29 Pin
30-31 Flap



Outer Wing Panel

1-20 Rib
21 Spar
22 Support
23 Bolt
24 Washer
25 Nut
26 Bracket
27 Eyebolt
28 Bolt
29 Nut
30 Support
31 Spar
32-33 Rib
34 Spar
35-50 Rib
51 Former
52 Rib
53 Former
54 Rib
55 Former
56 Rib
57 Former
58-59 Rib
60 Former
61 Rib
62 Former
63 Rib
64 Oil Temperature Regulator
65 Rib
66 Tee
67 Angle
68-69-70 Tee
71 Support
72 Bulkhead





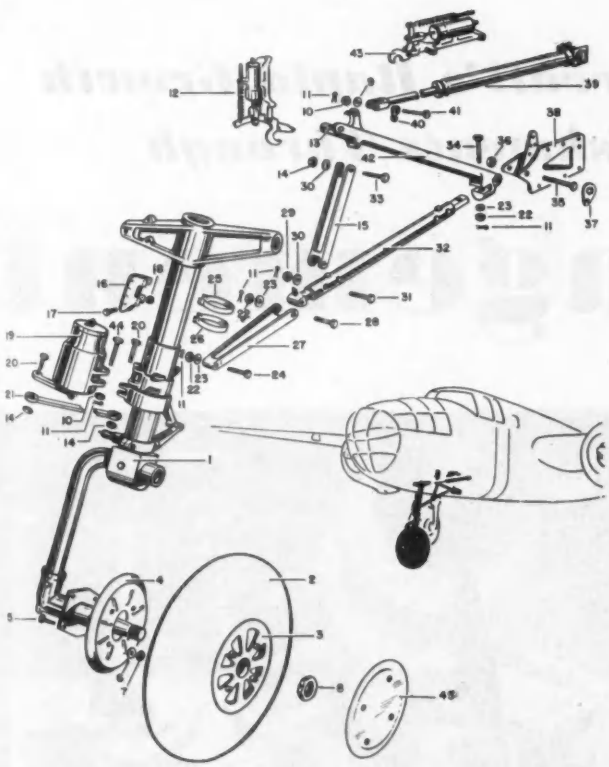
Fuselage Rear Section

1. Frame, rear fuselage; bottom frame
3. Rear observer's frame
4, 5, 6 and 7. Longer on fittings
8, 9, 10 and 11. Lonergons
19. Fuselage beam
21. Turret gunner's escape hatch window
22. Life raft door
26 and 27. Camera window frames
41. Bearing race
44. Rear gun blast pad
45. Rear gun blast plate
46. Front gun blast pad
47. Front gun blast plate
48. Life raft door gun blast pad
49. Raft door gun blast plate

the fuselage. A vertical stabilizer is attached to each end of the horizontal stabilizer, and rudders are hinged to these. Each vertical stabilizer is a full cantilever, semi-monocoque structure 8 ft 8 in. high with an area of 57.4 sq ft. Upper and lower tips are detachable. The twin rudders and elevators have combination booster and controllable trim tabs. Rudders and elevators have static balance weights in the leading edge.

Rudders are operated by hanging type rudder pedals in the pilot's cockpit through cables, push and pull rods, to the rudder horns. Elevators are operated by the control columns by means of cables that extend along each side of the fuselage to large bellcranks in the aft end of the fuselage.

(*Turn to page* 56, *please*)

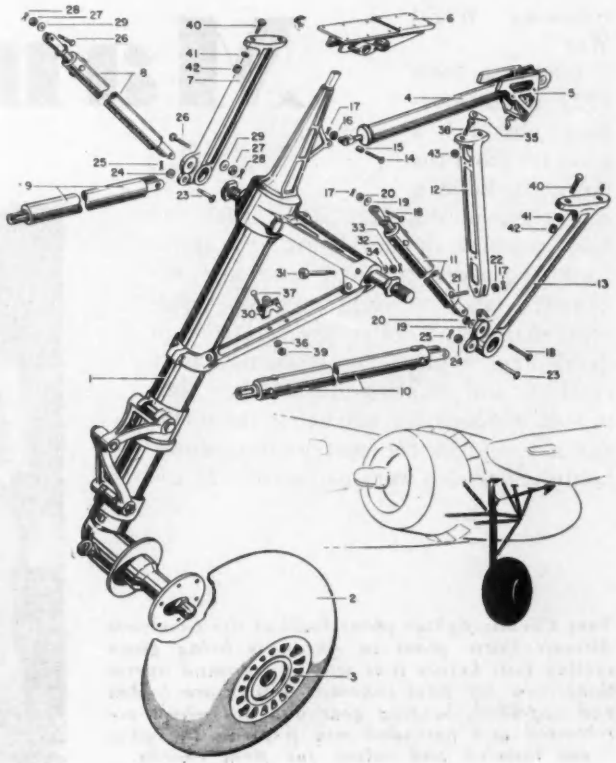


B-25 Main Landing Gear

1. Shock strut
2. 47-inch casing
4. Operating strut
5. Retracted latch
6. Extended latch
7, 9, 10, 12 and 13. Braces
30. Door operating fitting

B-25 Auxiliary Landing Gear

1. Shock strut
12. Extended latch
13. Needle bearing
15. Brace truss
16. Flap door cam assembly
19. Shimmy damper
32. Tube
39. Operating strut
42. Strut
43. Retracted position latch
45. Cover plate



After having been given special training in drafting young women from all sections of the country work over plans for Navy airships in the engineering lofts at the Goodyear Aircraft plant.

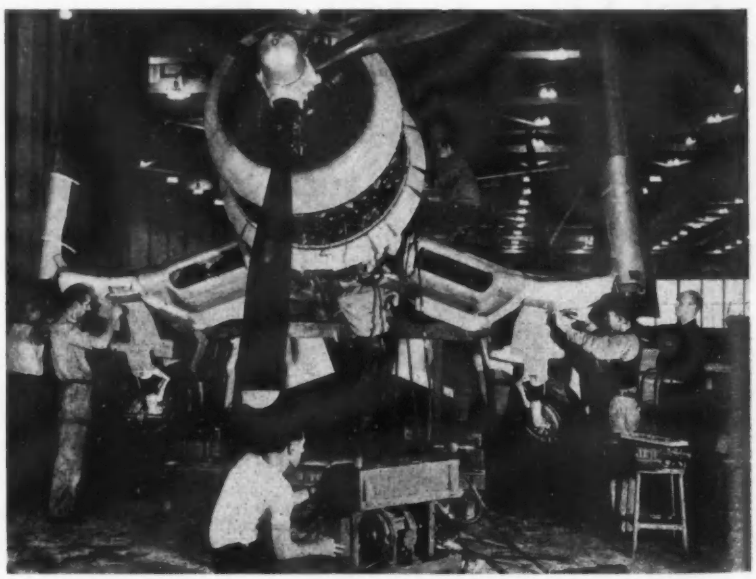
Goodyear Aircraft's Rapid Growth and Accomplishments Through

Management

GOODYEAR has long been a respected name in the rubber industry and is practically synonymous with tires. But when the Goodyear Aircraft Corp. was formed late in 1939 to undertake subcontracts for airframe parts such as ailerons, fins and stabilizers, not many realized that Goodyear had had a lengthy experience in aerodynamics, structural aluminum and similar aircraft problems. Starting with blimps for anti-submarine patrol in 1917, Goodyear built more than 100 non-rigid airships in the period of and immediately following World War I.

Dating from 1923, when Goodyear obtained a contract from the Army to build a semi-rigid airship, the RS-1, with the keel specified of duralumin, the company engineers began a long and exhaustive study of light metals. Goodyear engineers were in the forefront in developing methods of forming, heat treating and riveting duralumin. Improved methods for anodizing the metal and a technique for spot welding duralumin alloys also were perfected. In cooperation with the Aluminum Co. of America, Goodyear aircraft engineers also helped develop the 24S group of aluminum alloys. The building of the huge airships Akron and Macon, beginning in 1928, also gave Goodyear an invaluable background in fabricating structural aluminum and overcoming problems in stress, strain and fatigue resistance.

When Goodyear Aircraft Corp., a subsidiary of Goodyear Tire & Rubber Co., received its first World War II aircraft contract for ailerons, outboard and inboard flaps, stabilizers, rudders, elevators, and fins for the Martin B-26 bomber, Dec. 5, 1939, it was a skeleton organization of only 40 men. Within three and one-half years it has grown into one of the largest aircraft manufacturers in the Midwest, numbering 32,000 employes in five Akron plants. Floor space expanded in



Navy Corsair fighter plane built at the Goodyear Aircraft Corp. plant in Akron is being given cycling tests before it is sent to a ground operations crew for final tune-up. Wings are folded and unfolded, landing gear and tail wheel are retracted and extended end flaps in the wing are lowered and raised for final checks.

By E. L. Warner, Jr.

two years from 400,000 to approximately 4,000,000 sq ft, until it now exceeds Willow Run in total floor area. In addition, another 5000 workers are employed at another Goodyear Aircraft plant at Litchfield Park, Ariz. Despite its rapid growth, Goodyear Aircraft has earned a reputation with the armed services for quality of product and meeting schedules.

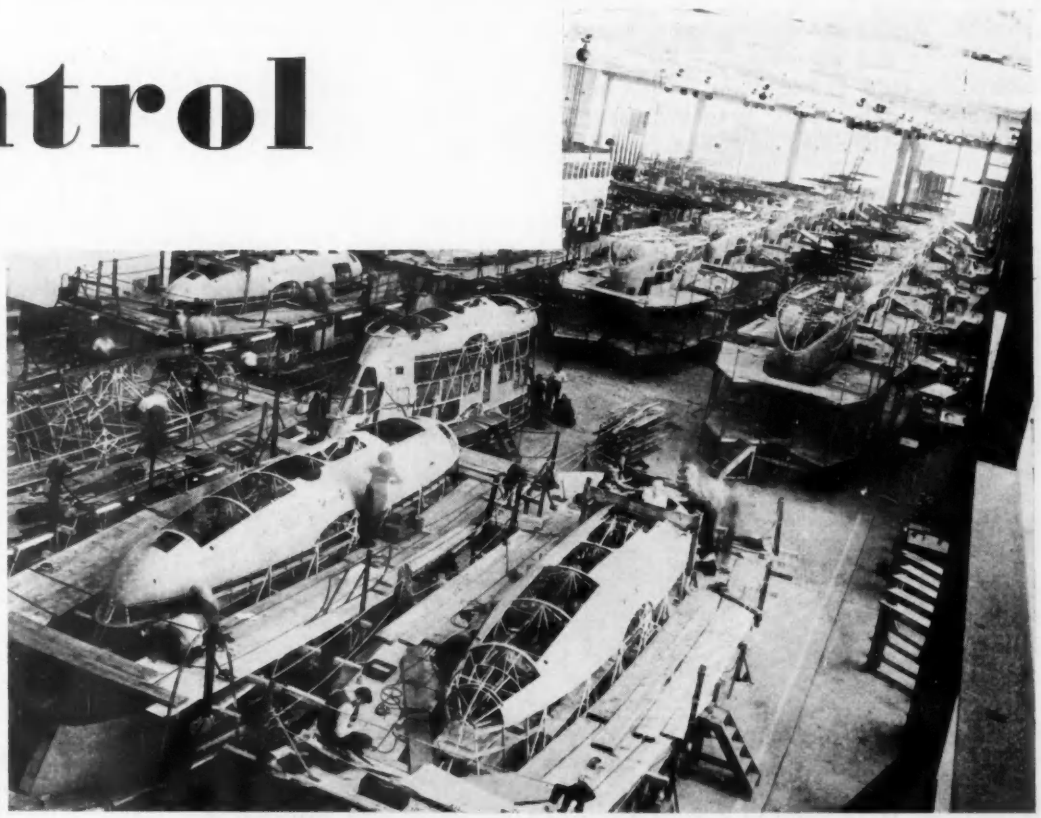
Management, men, materials and machines are the four necessary components for any manufacturing enterprise, but in Goodyear Aircraft there is particular emphasis on management. Under the able direction of Harry Blythe, former superintendent of the Los Angeles plant of the Goodyear Tire & Rubber Co., then assistant to the president at Akron, and later sales manager of the tire department for the entire company, Goodyear Aircraft has undergone this tremendous expansion with a minimum of growing pains. It has been able to draw upon the managerial resources of the world-wide Goodyear Tire & Rubber Co., as well as the particularized experience of Goodyear engineers in light metals and aerodynamics. Experienced aircraft supervision and skilled personnel was getting scarce when Goodyear Aircraft began to venture into the field on a large scale. No raids were made upon the aircraft industry, which already had expanded tremendously under the impetus of orders from Great Britain, France and Holland, as well as some early contracts from the U. S. Army Air Forces and the Navy.

After the initial order late in 1939 from Glenn L. Martin Co., which had been preceded some 15 years before by some forming work on duralumin frame members for the Navy's first all-metal frame Martin bomber, other orders came to Goodyear Aircraft. In the fall of 1940 contracts were received from Curtiss-Wright for stabilizers for the P-40, from Grumman for complete empennages for the Avenger and from Consolidated for wings, floats, flaps, ailerons and empennages for the Coronado patrol bomber.

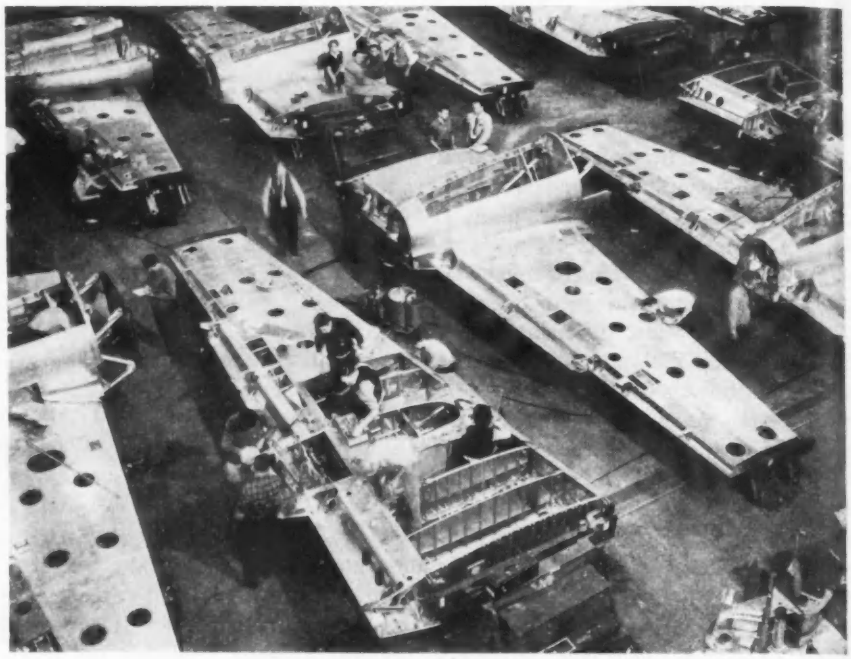
The first job for Martin, along with the work for these other contracts, was housed in the huge airship dock near the Akron airport. The dock, completed in 1929 when the rigid airship Akron was in the process of manufacture, is the largest building in the world without interior support. It is 1175 feet long, 325 feet wide and 211 feet high; so large, in fact, that it creates its own atmospheric conditions and rain can fall inside while outside all is sunshine. To provide heat for the workers, tents were raised inside the docks and jigs, welding units, presses and other machines were installed. Small gas-fired heaters maintained the air at a comfortable temperature inside of the tents and temporary lighting was rigged up. Manufacture of airplane wheel and brake assemblies, which had occupied auxiliary buildings adjacent to the dock, was moved elsewhere to make way for the expanded production of airframe parts.

Finally the airship dock was outgrown. An order

t Control



K-class—Airship Car Assembly Line—Goodyear Aircraft Corp.



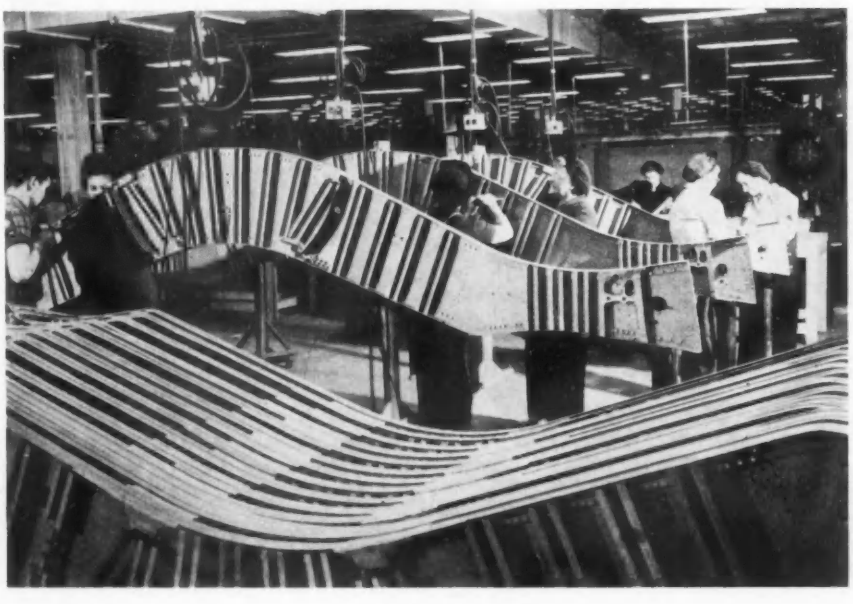
Martin B—26 Wing assembly at Goodyear aircraft plant.

for K-type airships for coastal anti-submarine patrol was received in October, 1940. This was followed by a volume order for wings, ailerons and empennages for the Martin B-26-C bomber in June, 1941. This latter order was part of the automotive bomber program in which Chrysler and Hudson furnished other major airframe subassemblies for the same plane. The first section of Plant B to house the manufacture of airship cabins was begun in July, 1941, while the first section of Plant C for the Martin wing and tail contract was started in June, 1941.

Goodyear Aircraft drew upon men in fields far distant from aviation to build its organization. Production supervision came from the rubber industry. Tooling experts were drawn from the automotive industry. Experienced engineers came from a variety of fields—civil, mechanical, automotive and industrial engineering. Goodyear Tire & Rubber Co. had 1500 men in the engineering department with 30 years' background in machine shop practice. They were familiar with metal as well as rubber, because they had had to design and build specialized machinery such as boring mills, lathes, engraving and milling machines, so they possessed the necessary versatility. Others from the rubber laboratory had a knowledge of rubber platens and die presses. Still others had built automobile rims and airplane wheels and brakes on a production scale. New management personnel was hired on the basis of previous records rather than previous experience, then trained to do the new job.

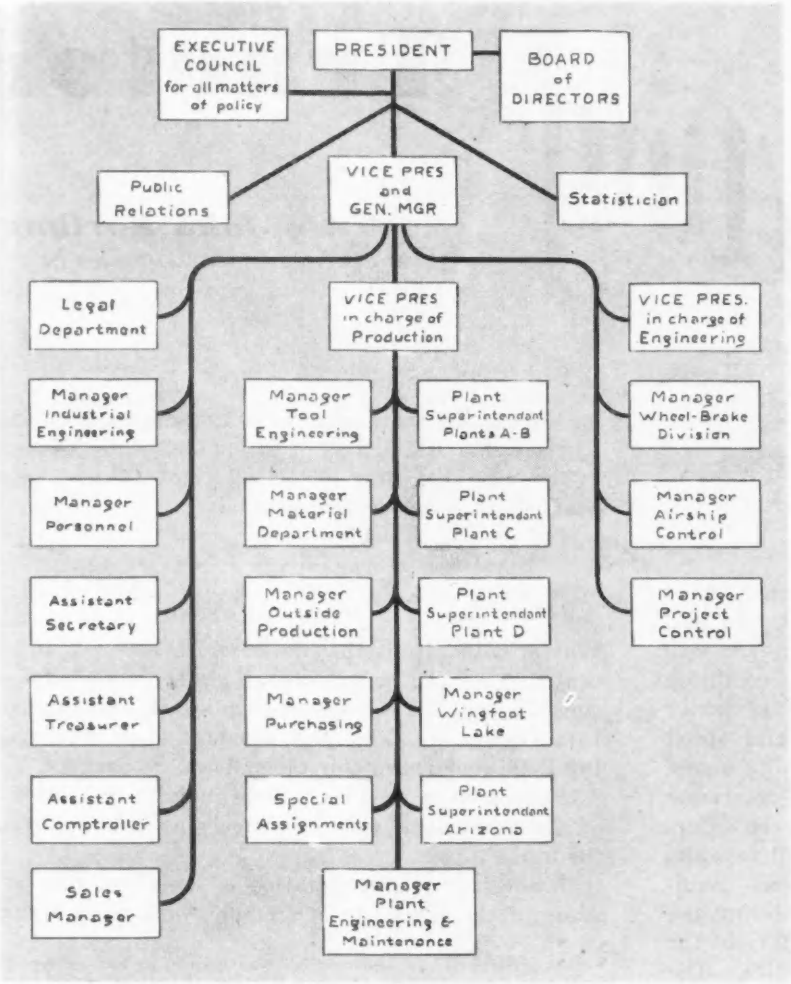
Another valuable source of managerial and supervisory talent was the "Flying Squadron," instituted by Paul Litchfield, then Goodyear vice-president, in 1913 to train promising young employes in many phases of the company's production or engineering work in order to qualify them for greater responsibility. This embraces a three-year training period in a wide variety of departments to provide company-wide experience as well as classes in blueprint reading, shop mathematics, rubber manufacturing practice and related subjects. Blythe himself is among the graduates of the "Flying Squadron." More recent graduates of the "squadron" proved invaluable in helping train thousands of men and women for new aircraft tasks as well as assuming positions as foremen and general foremen. As the draft made inroads on personnel, girls were added to the "Flying Squadron" training routine in 1941.

Goodyear Aircraft's engineering department grew from 17 men in 1939 to 1500 persons within two years. Individual jobs in the department were broken down into their component parts and persons without engineering experience were trained to do specific tasks in a short time. There were jobs which a bright high school girl or a girl with one or two years of college could do as



Stiffeners are applied to the main beam of a Corsair fighter plane in early stages of its construction at the plant of the Goodyear Aircraft.

Organization Chart of Goodyear Aircraft Corp.



well as a graduate engineer, even though not understanding the engineering principles, provided she went through an intensive four-month course in blueprint reading, drafting and mathematics. One hundred girls were added to the drafting room by this method.

Installed as chief engineer was Dr. Karl Arnstein, who has been with Goodyear since 1924, directing the construction of both the Akron and Macon. A native of Czecho-Slovakia, he has had 30 years' experience in aircraft structure, design, stress calculation and aerodynamics, having designed rigid airships for Germany prior to 1919. When the Treaty of Versailles called for dismantling of the Zeppelin works at Friedrichshafen, an agreement was reached transferring all patents and processes to Goodyear. Dr. Arnstein directed the building of the Los Angeles for the U. S. Navy at Friedrichshafen before coming to the U. S. where he became an American citizen after joining Goodyear.

In February, 1942, Goodyear Aircraft was given a letter of intent to manufacture the Vought Corsair, Navy carrier-based fighter plane, heretofore made only by the Chance-Vought Division of United Aircraft Corp. at Stratford, Conn. This necessitated another new plant, Plant D, construction of which began in February, 1942, as the other factories already were filled with the K airship, Martin B-26 wing and empennage and a variety of other airframe orders, including new ones for Martin Mariner patrol bomber empennage flaps and ailerons and for Northrop Aircraft, Inc. Detailed engineering information had to be obtained from Chance-Vought. Some of this was incomplete because when designing and planning the plane for production, the Chance-Vought engineers expected that the original designer would be the only producer. Loft and contour information was not as detailed as necessary for an outside company coming in on this type of job. There were conflicts between the templates and the drawings. To insure accuracy, Goodyear engineers borrowed the original scribed metal templates from Chance-Vought and had reproductions made in a nearby shop at Stratford. Complete detailed lofts were prepared for checking purposes, a sort of lofting in reverse process.

Goodyear Aircraft engineers devised some production innovations derived from their previous experience in forming light metals. Equipment was designed to stretch and form simultaneously leading and trailing edge sections, cap strips, angles, ribs and longerons. The stretcher block of wood is made to

(*Turn to page* 70, *please*)

Interior of Goodyear's huge airship dock, with canvas covering over machining operations to make heating more practical.

Predicting Tractor

By John Borland*
The Timken Roller Bearing Co.

THE procedure in determining the expected life of a bearing when it is subjected to a constant load at a constant speed is relatively simple and well established in the industry. However, such a condition rarely, if ever, applies to the bearings in a tractor transmission. Here, the loading varies with speed changes and with the location of the meshing gears. Under such conditions, it is necessary to determine the *weighted* life, taking into consideration the different loadings under which the bearing will operate. The method is to check the loading under each condition to determine its life factor, and considering the various life factors and the percentage of time for which each applies to obtain a weighted life. The life factor is derived from the manufacturer's catalog rating for the particular operating speed divided by the radial load (effect of thrust load added, if any).

The weighted life, for example, of tapered roller bearings is given by the formula:

$$\text{B-10 Life} = \frac{3000}{\left(\frac{T_1}{\text{L.F.}_1}\right)^{3.32} + \left(\frac{T_2}{\text{L.F.}_2}\right)^{3.32} + \ldots}$$

Where, B-10 Life is the life at which not over 10 per cent failures can be expected, T_1 is the percentage of time for which Life Factor$_1$ applies, T_2 the time for Life Factor$_2$ etc. The 3000 constant is derived from the B-10 hour rating for tapered roller bearings. The 3.32 exponent is used since tests indicate that the life of these bearings varies inversely as this power of the load.

In addition to consideration of weighted life, any study of the exact life of tractor bearings in service

* This article is an abstract of the paper presented by Mr. Borland at the National Tractor Meeting of the Society of Automotive Engineers Sept. 23-24 in Milwaukee, Wis.

Data on Tractors

Tractor No.	Max. belt hp corrected to sea level at rpm (From Nebraska test)	Max. torque in lb-ft	Weight, with fuel, oil, water, operator plus water in rear tires	Hp per 100 lb weight	1st Gear				2nd Gear				3rd Gear				4th Gear			
					Per cent of time	Tan. force on wheels	Mph	T. F. / Wt.	Per cent of time	Tan. force on wheels	Mph	T. F. / Wt.	Per cent of time	Tan. force on wheels	Mph	T. F. / Wt.	Per cent of time	Tan. force on wheels	Mph	T. F. / Wt.
1	16.31 at 1400	61.2	2280	0.717	15	1130	2.59	0.495	70	718	4.08	0.315	15	371	7.90	0.163				
2	23.81 at 1500	83.5	2501	0.952	15	1760	2.42	0.701	70	1110	3.84	0.443	15	577	7.40	0.230				
3	15.21 at 1850	43.2	2538	0.598	15	1400	2.94	0.552	70	993	4.24	0.391	15	465	8.42	0.183				
4	15.26 at 1400	57.3	2727	0.560	20	1524	2.54	0.558	60	1139	3.45	0.417	20	714	5.85	0.261				
5	23.81 at 1500	83.5	2501	0.952	15	1760	2.42	0.701	35	1230	3.47	0.490	35	880	4.86	0.352	15	452	9.45	0.181
6	19.51 at 1500	68.3	2790	0.700	10	1420	2.59	0.508	30	1070	3.43	0.384	50	825	4.57	0.296	10	622	6.10	0.225
7	22.10 at 1400	83.0	3006	0.735	20	1350	2.60	0.449	35	1310	3.55	0.437	35	1110	4.56	0.369	10	570	9.85	0.189
8	24.10 at 1400	90.5	3417	0.705	1	2075	2.30	0.607	29	1440	3.30	0.423	67	1105	4.28	0.324	3	407	12.0	0.119
9	31.43 at 1300	127.0	3571	0.880	15	2200	2.54	0.617	35	1500	3.70	0.420	35	1130	4.90	0.316	15	608	9.40	0.170
10	32.88 at 1500	115.0	4113	0.800	0	2800	2.28	0.680	13	2350	2.72	0.570	47	1660	3.80	0.408	40	1330	4.78	0.324
11	20.54 at 1150	93.8	4475	0.459	15	2263	2.61	0.506	35	1743	3.43	0.365	35	1383	4.45	0.309	15	1101	5.88	0.246
12	33.38 at 1500	116.5	5096	0.655	10	2640	2.63	0.518	30	1930	3.60	0.378	50	1525	4.70	0.300	10	1120	6.38	0.220
13	30.98 at 975	167.0	5504	0.562	15	3335	2.51	0.605	35	2595	3.34	0.471	35	2050	4.41	0.372	15	1665	5.70	0.302
14	44.85 at 1275	185.0	6412	0.700	3	3280	2.75	0.512	12	2540	3.55	0.396	47	1925	4.70	0.300	38	1455	6.20	0.227

Bearing Life

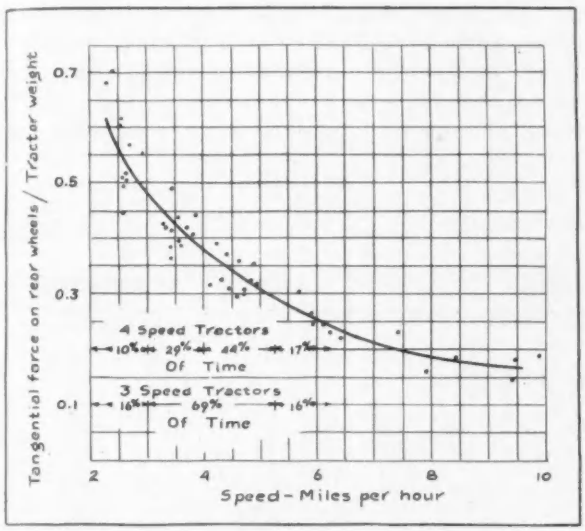


Fig. 1—Average operating conditions in terms of tangential force on rear wheels

must also include such factors as—bearing mounting, alignment, deflections, lubrication, cleanliness, etc. Some of these factors can be minimized or eliminated by proper design while others are beyond the control of the manufacturer. Assuming that factory adjustments are maintained, the principal cause of bearing failure will be the lapping action of dirt that may find its way into the case. Even an increase in the bearing size will not necessarily offset the effects of rapid wear caused by the presence of dirt. Therefore, it must be assumed that the operator will keep the lubricant reasonably clean when selecting bearings on the basis of fatigue life.

Manufacturers have made a concerted effort to aid in the more exact determination of the correct bearing size for tractors by assembling their own test experiences and those of representative farmers throughout the country. From these data it has been possible to estimate the percentage of time the tractors studied were run in each gear. Also, from the information available on fuel consumption, the percentage of full power normally used is known. Most manufacturers are in agreement as to the percentage of time a tractor is used in various speeds. However, estimates on the percentage of full power that passes through the transmission varied widely, ranging from 50 per cent of the maximum motor torque to 75 per cent of the maximum draw-bar horsepower as developed on the Nebraska test. Most engineers are of the opinion that it is incorrect to figure transmission bearing loads from the peak motor power; instead, they should be figured back from the draw-bar pull.

The first four tractors listed in the data chart (see accompanying table) are 3-speed designs, while the others have four or more speeds. In the case of the latter, only the four lowest speeds were considered since the loads at the higher speeds are relatively light, even at full motor torque. All tractors covered in this table are pneumatic-tired.

Note, in the fourth column (hp per 100 weight), the wide variation between the tractors. This clearly indicates the fallacy of checking transmission bearing loads on the basis of full motor power when only a portion of this power can be used at the draw-bar.

The data supplied in this table can best be used by an analysis from two standpoints: 1. The percentage of time the tractor is used in its various speeds; and 2. The relationship between the ratio of the tangential force on the rear wheels to tractor weight as compared to the miles per hour speed. With reference to item 1, the estimates of various manufacturers have been averaged as follows:

3-Speed Tractors

Low gear—up to 3 mph—16 per cent of time

Second gear—between 3 and 5¼ mph—68 per cent of time

Third gear—over 5¼ mph—16 per cent of time.

4-Speed Tractors

Low gear—up to 3 mph—10 per cent of time.

Second gear—between 3 and 4 mph—29 per cent of time

Third gear—between 4 and 5¼ mph—44 per cent of time

Fourth gear—over 5¼ mph—17 per cent of time.

(Turn to page 52, please)

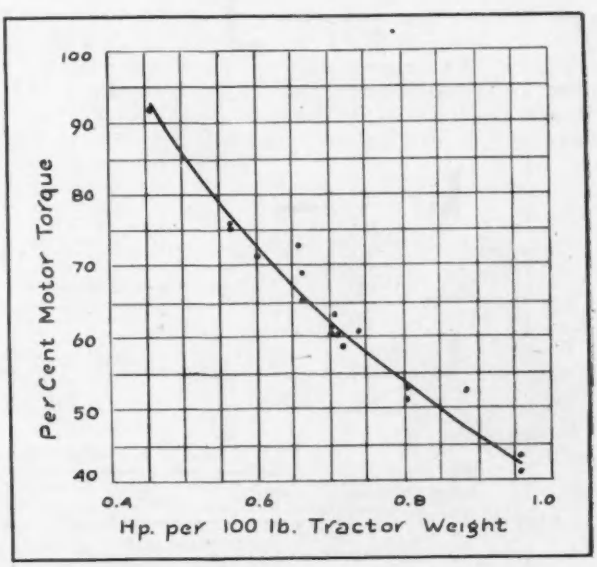
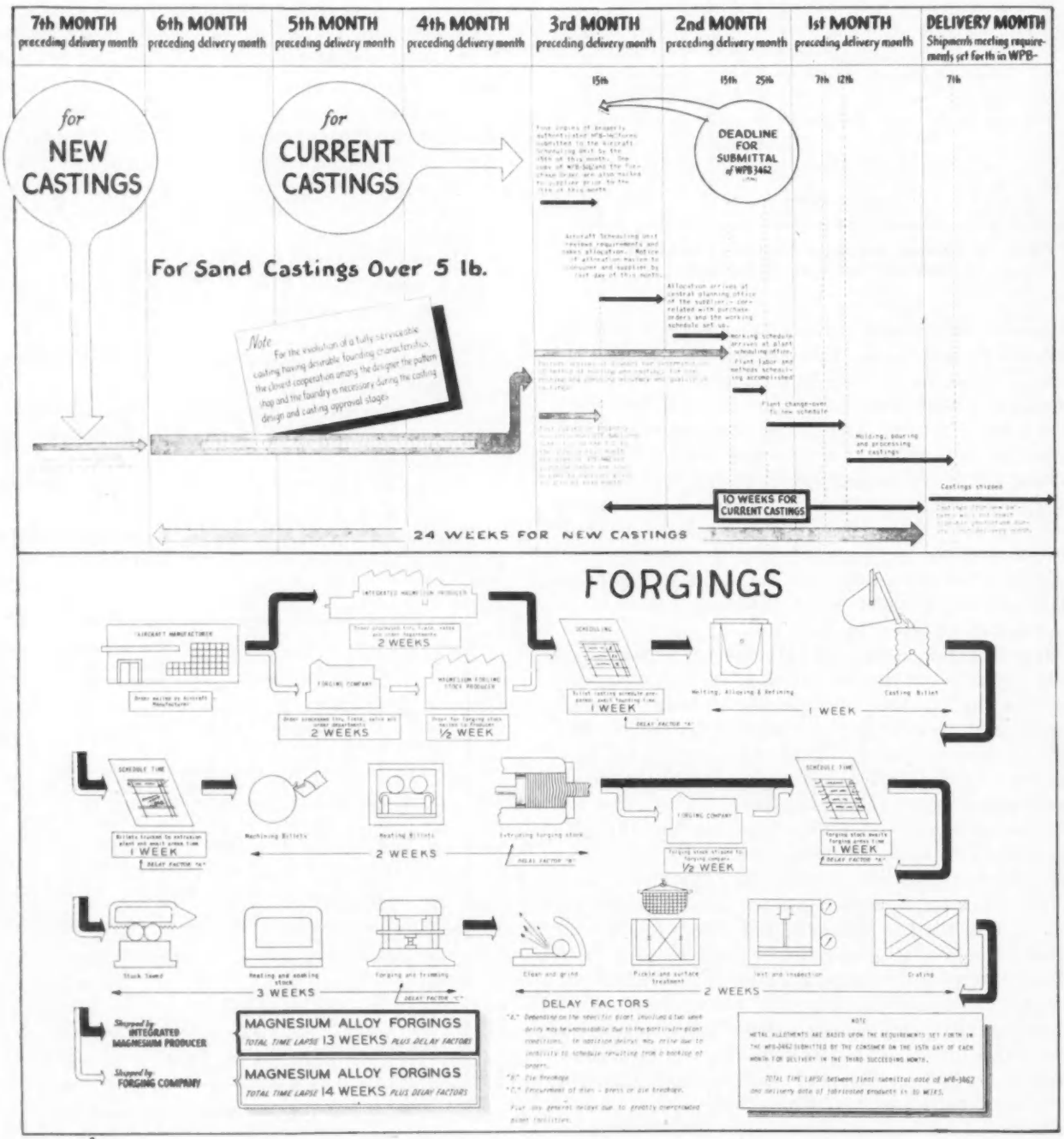


Fig. 2—Average operating conditions in terms of percentage of motor torque

Time Cycle for Procurement of Aircraft Magnesium Alloys

THESE charts have been prepared by the Materials Branch, Resources Control Section, at Wright Field, to facilitate the procurement of magnesium sand castings and forgings. Magnesium is not a C.M.P. controlled material, distribution being by allocation, but with its wider application in aircraft production, a knowledge of the time cycles for procurement of magnesium commodities is important.

The Aircraft Scheduling Unit at Wright Field and the War Production Board have cooperated in simplifying magnesium procurement and distribution procedure. The forms for requesting allotments have been changed and, beginning in January, requests are made on Form WPB-3462 which applies to consumers who use magnesium products for non-aircraft purposes as well as those whose output is for aircraft. Aircraft consumers file with ASU; non-aircraft consumers with WPB.

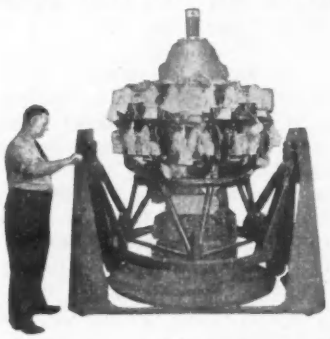

7th MONTH preceding delivery month
6th MONTH preceding delivery month
5th MONTH preceding delivery month
4th MONTH preceding delivery month
3rd MONTH preceding delivery month
2nd MONTH preceding delivery month
1st MONTH preceding delivery month
DELIVERY MONTH Shipments meeting requirements set forth in WPB-
15th
15th 25th
7th 12th
7th
for NEW CASTINGS
for CURRENT CASTINGS
DEADLINE FOR SUBMITTAL of WPB 3462
For Sand Castings Over 5 lb.
Note
For the evolution of a fully serviceable casting having desirable founding characteristics the closest cooperation among the designer the pattern shop and the foundry is necessary during the casting design and casting approval stages
10 WEEKS FOR CURRENT CASTINGS
24 WEEKS FOR NEW CASTINGS
FORGINGS
2 WEEKS
2 WEEKS
½ WEEK
1 WEEK
1 WEEK
2 WEEKS
½ WEEK
1 WEEK
3 WEEKS
2 WEEKS
Shipped by INTEGRATED MAGNESIUM PRODUCER
Shipped by FORGING COMPANY
MAGNESIUM ALLOY FORGINGS TOTAL TIME LAPSE 13 WEEKS PLUS DELAY FACTORS
MAGNESIUM ALLOY FORGINGS TOTAL TIME LAPSE 14 WEEKS PLUS DELAY FACTORS
DELAY FACTORS
NOTE
METAL ALLOTMENTS ARE BASED UPON THE REQUIREMENTS SET FORTH IN THE WPB-3462 SUBMITTED BY THE CONSUMER ON THE 15TH DAY OF EACH MONTH FOR DELIVERY IN THE THIRD SUCCEEDING MONTH.
TOTAL TIME LAPSE between final submittal date of WPB-3462 and delivery date of fabricated products is 10 WEEKS.

New Products for Aircraft

Portable Engine Assembly Stand

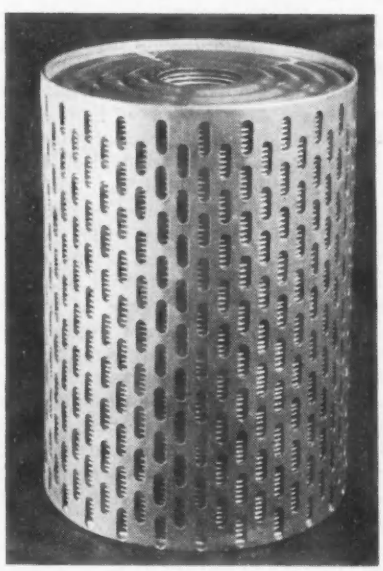
A portable engine stand for assembly and overhaul of the new Wright Cyclone engine has been placed on the market by the Clayborne Manufacturing Co., Chicago, Ill. This model, AC-24, is now offered exactly as supplied to manufacturers of the engines, complete with oil pan with pipe connections and drain valve.

The manufacturer states that Model



Clayborne portable engine stand

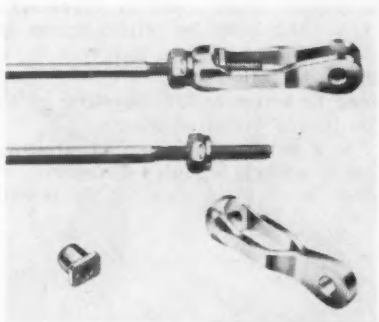
AC-24 is supplied without the test mount shown in illustration. The ring supporting the test mount revolves on ball bearings. It is pointed out that this engine stand cannot be turned over, due to out of balance condition, without an engine on it. However, if engine is removed while in flight position the stand can be brought back to bottom position by the crank—but assistance would be required to reverse this operation. The stand has been streamlined for safety and appearance and is built of ¼-in. boiler plate stamping.



Micronic Filter for hydraulic systems of aircraft

P & N Socketype Clevis Rod End

A P & N Socketype clevis rod end that uses a newly designed Socketnut in place of a cable end is announced by Poulsen & Narden, Los Angeles, Cal. This clevis rod end uses the P & N Socketype terminal developed a year ago by Poulsen & Nardon, but in place of the cable end a Socketnut fits snugly in the socket of the terminal. This Socketnut is produced with right or left hand threads and with opposite sides slightly flattened to allow tightening with an end wrench. Any degree of tightening may be obtained without



P & N Socketype clevis rod end

distortion. The Socketnut holds the terminal against a hex nut and both are drilled for lock wires. The terminals are stamped from alloy steel and then cadmium plated. Tests are said to have shown a strength factor in excess of rod strengths.

Filter for Aircraft Hydraulic Systems

Adel Precision Products Corp., Burbank, Cal., has just brought out a new filter for use in the hydraulic systems of large aircraft.

Designated as the "Micronic Filter" because it filters particles of 5 microns and larger, meeting the requirements of Army and Navy specifications, this filter operates from 65 deg F below zero to 165 deg F above. The filtering cartridge itself expands and contracts with the varying temperatures encountered.

The model illustrated measures 6 in. x 8½ in., weighs 2 lb and has 3800 sq in. of filtering area. Rated output is 1800 gph at 100 deg F with pressure drop of only 16 oz filtering AN-VV-O-366a hydraulic fluid. Inlet opening is 1½ in. in diameter. Filtering flow may be arranged for either direction.

An automatic pressure relief is incorporated to bypass the full flow of liquid at any predetermined pressure setting, should line surges peak beyond a safe point. Filter operates in any position; however, generally accepted aircraft practice locates the 1½-in. opening at the bottom.

Dural alloy is used for the metal parts of the filter, although tooling is arranged to permit the use of other alloys, such as stainless steels for the food industry and other individualized applications.

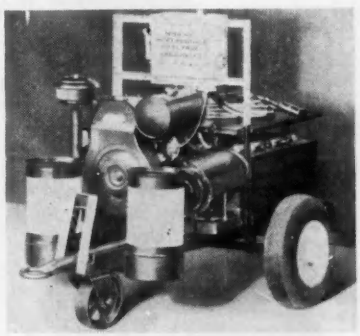
The filter is also available in 4-in. and 6-in. sizes, with capacities of 900 gph and 1350 gph respectively.

Auxiliary Power Unit

A 24-volt type gas engine driven generator and battery unit, called the Pony Express Field Service Unit, is being manufactured by the Rocky Mountain Steel Products Company, Los Angeles, Cal.

This auxiliary power unit is for field use in starting aircraft engines, testing gun turrets and radios, as well as the entire airplane electrical equipment requiring 24 volts direct current. It consists of a gasoline engine driven generator of 1200 watts capacity; voltage and current regulator; two heavy-duty 12-volt batteries connected in series and mounted on a chassis having two 16-in. steel wheels and one 8-in. caster wheel.

(*Turn to page* 68, *please*)



Pony Express Field Service Unit

New Production

THE Onsrud Machine Works, Chicago, Ill., has developed and built a new type high speed non-ferrous milling machine for milling long, flat bevels on aircraft wing and fuselage sheet stock so that skin sheet sections may be lapped to form a perfectly smooth surface. Bevels with surface widths up to 8 in. may be machined. Surfaces are milled to a mirror finish in a single pass.

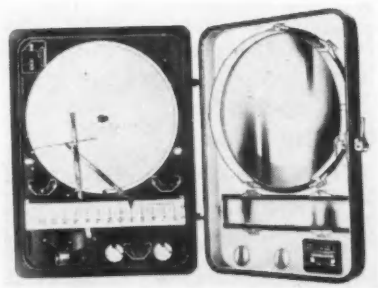
Basically, this machine consists of a long bed and T-slot table on which work is held. A carriage travels over the bed to move the cutter head along the work. The bridge arm of the carriage holds two cutter heads, each of which may be tilted up to 15 deg off perpendicular, in a vertical plane parallel to a vertical plane running lengthwise with the bridge arm.

Bevels may be milled on work in two different types of operations, and the nature of the work, of course, determines which type is employed.

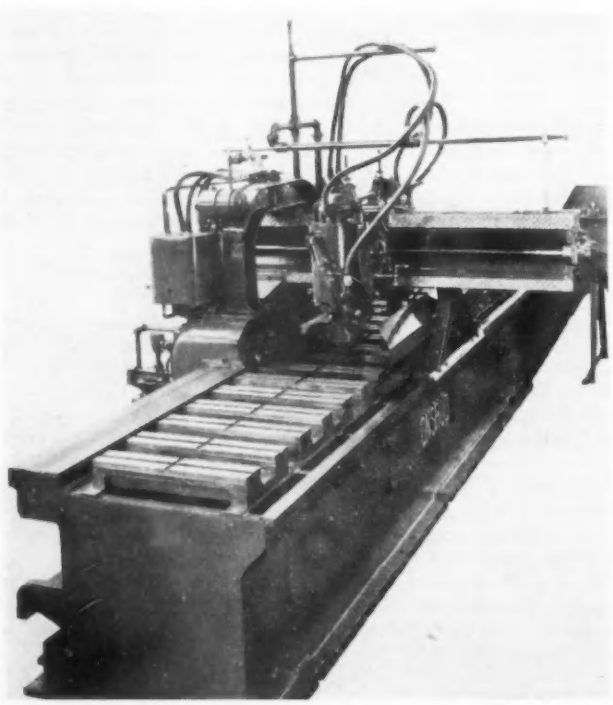
For a constant or straight line bevel, work is set up on the table so that the bevel milled will be parallel to the direction the carriage travels, or in other words, parallel to the length of the bed. The bridge arm is positioned to form a 90 deg angle with the length of the bed and direction of carriage travel.

Cutter heads are set at the angle required to make the bevel. Both cutter heads may be used in one pass if necessary. End mill type or fly cutters may be used for a recommended maximum working diameter of 8 in. Cutters are directly driven at 3600 rpm by 15 hp motors. In this type of setup, the carriage is driven over the bed and the bevel is milled as the carriage travels over the work. On the machine illustrated, with a 15 ft bed, a bevel up to 110 in. in length may be milled using one cutter motor, and a bevel up to 78 in. long may be milled using two cutter motors. This machine is designed to allow bed sections to be added to accommodate beveling of this type to any required length.

For a bevel on a taper or crosswise edge, the work is milled by moving the cutter head in a vertical or untilted position across the bridge arm screw. Work is held in a fixture in a tilted plane to the angle of the bevel required. Bevels of this type can only be as long as motor travel across the bridge arm permits, 30 in. travel being the maximum for a 90 deg crosswise edge, and less for the taper edge, depending on the angle of the taper.



Bristol Model 431 Potentiometer.



Onsrud traveling carriage milling machine.

THE Bristol Company, Waterbury, Conn., has redesigned its Pyromaster Self-Balancing Potentiometer. The new Model 431 instrument has a universal wall on flush mounting case that is considerably deeper than the previous Model 440M, and has an internal hinged panel on which are mounted pen and indicator drive mechanism, and, in the case of electric controllers, the control contacts or proportioning slide wire, or in the case of air control, the complete new convertible-type air operated control mechanism.

This deep case and inner panel make it possible to service or replace any part or portion of the instrument without disturbing any other part. It also makes it possible, in the case of electric type controllers, to include the control relays in the instrument thus eliminating considerable external wiring.

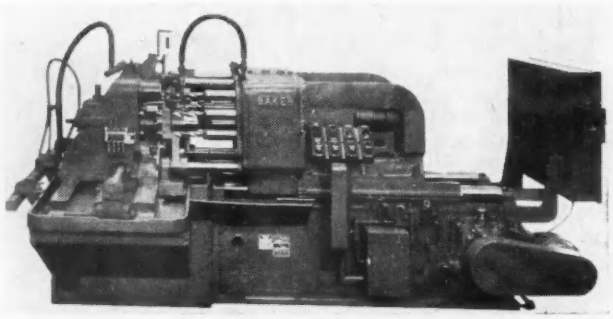
A heavy-duty pen-drive motor gives more torque for operating control contacts and other similar functions, especially under conditions of poor line voltage regulation. The indicating scale on the indicating-recording model has been changed to a horizontal wide band instead of the rectangular dial-type provided on the Model 440M.

The stepping relays and the slide wire in the potentiometer circuit have been enclosed in a dust-proof bakelite housing, and a heavier power supply has been provided. Another change is that a standard cell type of manual standardizing circuit now replaces the voltmeter type originally supplied.

The Model 431 Pyromaster uses the same basic principle as previous models, providing a self-balancing round-chart recording potentiometer that has no continuously moving mechanical elements, is uneffected by vibration, and needs no lubrication.

BAKER BROTHERS, INC., Toledo Ohio, have developed a fully automatic cycled multiple spindle, multiple opera-

Equipment

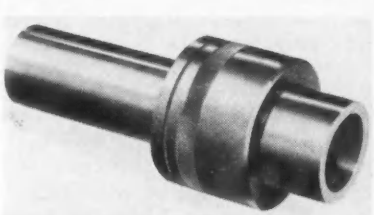


Baker horizontal hydraulic feed multiple spindle machine.

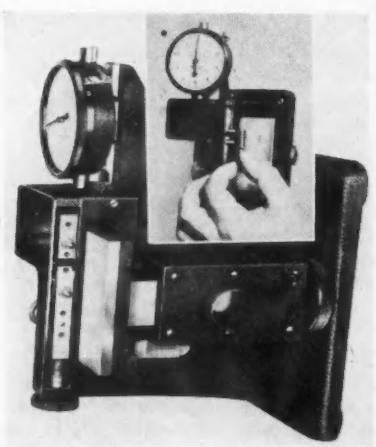
tion machine. It handles a magnesium cover for an aircraft engine, and holds the bores and counterbores to very close limits in relation to each other. It also holds the diameters of the bores and counterbores to very small tolerances.

The only part of this machine which is of standard design is the 3½ by 24 unit. The entire multiple spindle head and drive on the top of the saddle, and the end bed carrying slide for moving the work holding fixture, are special for this particular job. The unit multiple head carries 15 spindles, with a group of 8 spindles at the front first cutting station. These spindles are used for drilling several of the holes from solid, and for rough boring the large center bore of the part. The rear second section of the head is arranged with 7 additional spindles for finish boring and finish counterboring. Except for loading and unloading, all operations of the machine are performed automatically.

BETTER correction of misalignment, both off-center and out-of-parallel, is claimed for a floating tool holder announced by Empire Tool Co., Detroit, Mich. Being made of five component parts — the moving parts riding on rollers so placed as to affect a perfect self adjustment of the float in any direction — the Empire Floating Tool Holder is said to ream holes with close tolerances to absolute size and perfect roundness. The rollers contribute to making the members antifriction and to producing smoother running. The possibility of making bell-mouthed holes is eliminated. There are no parts to fall out or get lost when holder is taken apart.



Floating tool holder made by Empire Tool Co.

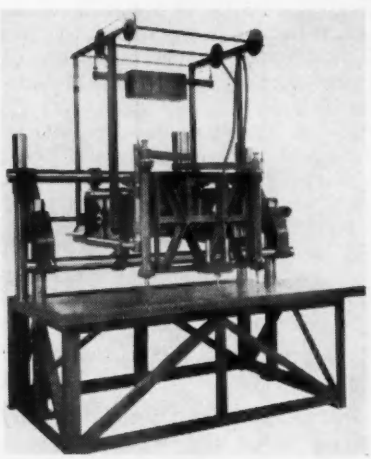


Federal Model 1141 thread-lead inspection gage.

FEDERAL PRODUCTS CORP., Providence, R. I., has just placed on the market a thread inspection gage, Model 1141. The gage is adjustable both for thread lead and diameter. The sensitive contact point is free to float laterally with the axis of the thread and so set itself positively between the sides of the thread itself. This sensitive contact is so mounted that it transfers its motion to the dial indicator through a very sensitive mechanism, thus insuring the accuracy of the inspection operation. The gage is set with a master.

The dial indicator is graduated to read in .0001 in. and the capacity of the gage will take care of threads up to 1½ in. in diameter, a maximum distance between points of 2 11/16 in. and a minimum distance of 3/16 in. With a special attachment a minimum distance of .156 in. can be checked.

CENTURY ENGINEERING COMPANY, Los Angeles, Cal., has developed a high speed duplicating machine for quick and accurate production of parts from forged stock. Two spindles, with a speed of 10,000 rpm are driven by a 10 hp motor. The operation is manual in the vertical and fore and aft planes, with longitudinal movement controlled by the switch buttons located at the top of each handle. This control moves the carriage right or left to determine the amount of cut.



Century duplicating machine.

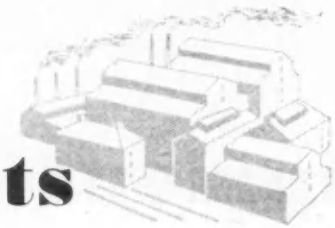
The Century Duplicating Machine does not require skilled labor, and setups are said to be made quickly and easily. With this machine, expensive dies and forgings are unnecessary for a limited production run.

Method of Making Prototype Dies

A new production system for making drop hammer dies for prototype and sample parts has been installed in the plants of Castaloy Corporation in Detroit and Los Angeles. The uniform procedure embraces the following steps: the construction of a master model or template; production of a plaster pattern of this master model by casting; the casting of dies, embodying the identical contours of the master model, from the plaster pattern. This process not only produces a die for the stamping of the parts, but also provides a means of casting checking fixtures for other subsequent operations

(*Turn to page 92, please*)

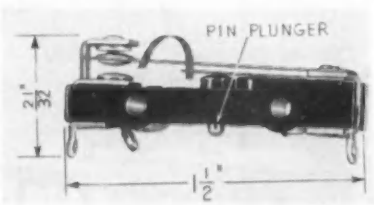
New Products



Small, Lightweight Acro-Snap Switch

An Acro-Snap Midget Switch, built on the rolling spring principle and made to the maximum dimensions of 1½ in., is offered by the Acro Electric Co., Cleveland, Ohio. It is 9/16 in. wide, 7/16 in. thick and weighs less than an ounce.

All component parts are non-corrosive. The switch is designed for actuation from either the top or the bottom. It is adapted to electronic control devices, machine tools, aircraft and electrical appliances. Fully approved—having stood the Winterization tests under Army Air Force Directive 21A, including salt spray tests and both high and low temperature tests. Both the snap-action spring itself and the center blade are made of beryllium, while the base is of bakelite. Under factory tests the switch is said to have shown no failure after 94 million operations. When built into relays, smaller coils may be used as only 4 to 6 oz operating pressure is required. Furnished in single pole, normally open, normally closed, and double throw with both pre-travel and over-travel provided.



Acro-Snap Midget Switch

General Purpose Welding Electrode

A new general purpose arc welding electrode for welding mild steel in all positions, with either alternating or direct current, is announced by The Lincoln Electric Company, Cleveland, Ohio.

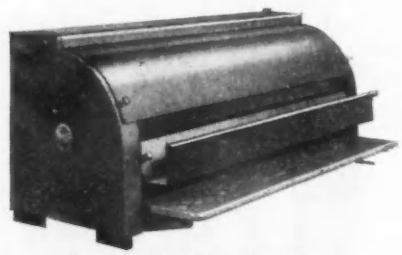
The new electrode, named "Fleetweld 37," is the most recent addition to the "Fleetweld" group of Lincoln electrodes for welding mild and low alloy steels.

A feature of the new electrode is that there is no slag interference when welding vertical down. This means excellent results are achieved in this position, the one in which greatest welding speeds on 8 to 16-gage steel are obtained.

The ability of "Fleetweld 37," to withstand higher currents, both alternating and direct, is said to make possible higher welding speeds than normal and its easy handling characteristics in all positions make it an ideal electrode for general purpose work. The fact that with proper currents it will neither stick to the work nor burn through makes the electrode especially desirable for light gage welding.

Pease Whiteprint Developing Machine

A moderately priced table model for dry developing whiteprint reproductions of engineering drawings and tracings has been made available by The C. F. Pease Company, Chicago, Ill. This machine, known as the Pease "700," is a developer only, with two production speeds—4 and 8 ft per min. Pease "700" can be used in conjunction with any blueprinting or direct process printing machine using any dry direct process paper. It is especially suited to operate with the Pease "77" and Pease "66" high pressure quartz tube-printers using Pease Multazo Whiteprint Paper (Dry Direct Process).

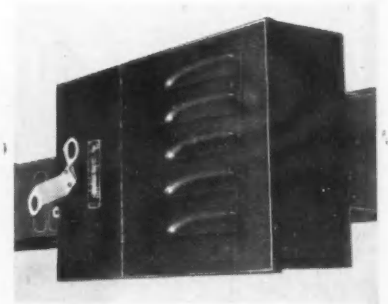


Pease whiteprint developer

The new Pease "700" developer features easy accessibility through quickly removable sheet metal guards, compactness of design and two forward speeds. It is made in two sizes, 42 and 54 in.

Capacitor Plugs for Plug-In Duct

Bulldog Electric Products Co., Detroit, Mich., has just brought out a line of Capacitor Plugs for plug-in duct. These new flexible Capacitor Plugs can be inserted into any convenient plug-in opening along a Bus Duct run. They can be mounted at the centers of the greatest load areas, or can be readily moved about as the load areas change.



Bulldog Capacitor Plugs

The Capacitor Plugs are an integral unit consisting of 60-amp, 3-pole fusible switches, or 15 to 50-amp circuit breakers connected ahead of 3-pole single unit Capacitors having discharge resistors. They are made for 230 or 460-volt, 60-cycle service in capacitor ratings of 1 to 15 kva. To facilitate pull-chain operation from the floor, the plugs have operating mechanisms of special design placed on the hinged covers over the protective devices. Louvered screw-on covers are provided over the capacitor units.

It is claimed that when a system is overloaded that Capacitor Plugs will improve or relieve the situation entirely. Also that a Capacitor Plug installation frequently makes possible the addition of new load without adding to the bus bar sizes already in use, and that the Capacitor Plugs use less critical material than other means for the quick release of system capacity.

Du Pont Announces a New Plastic

A new plastic, polythene, adaptable to the manufacture of products as varied as collapsible tubes for toothpaste, water-proof coatings, piping, adhesives and insulation for electric wiring and cables was announced by the Plastics Department of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

This new member of the plastics family represents the culmination of intensive experimentation and development undertaken five years ago and

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Aircraft Engine Output High Despite Cutbacks at Two Plants

Automotive Manufacturers Making Engines for Military Planes at a Rate in Excess of 11,000 Units Per Month

Reaching the mass production stage, automotive manufacturers are turning out aircraft engines for military planes at a rate in excess of 11,000 units per month. This has been attained in spite of the fact that two producers of power plants for four-engine bombers, Buick and Chevrolet, have been cut back temporarily after reaching new peaks last November. Studebaker Corp., which is making Wright Cyclone 9-cyl. 1,200-h.p. engines for the Flying Fortress, manufactured 22,925 of these units in 1943, according to H. S. Vance, board chairman. This is more than three times 1942 output of 7,091 units and brings Studebaker's total Wright engine production to 29,016 units. In November Studebaker shipped enough engines to equip more than half of the announced production of U. S. four-engine bombers of all types, which exceeded 1,000 planes for the month. Studebaker's final assembly of these engines is in a new plant at South Bend, Ind., while a new plant at Fort Wayne, Ind., manufactures gears and one at Chicago supplies other components.

Packard Motor Car Co. had produced 27,956 Rolls-Royce aircraft and Packard marine engines up to Jan. 1, according to President G. T. Christopher. Shipments of these engines totaled $355,000,000 in 1943, 3½ times greater than Packard's biggest automotive year. Present rate of output indicates Packard as the largest builder of liquid-cooled aircraft-type engines, which includes both airplane and marine. Volume in 1944 is expected to reach $500,000,000 in line with increased schedules, which are abetted by Packard's expanded aircraft engine output through operation of its new DPC plant at Toledo. Continental Aviation & Engineering Co., also is tooling up to produce Rolls-Royce engines at a new DPC plant at Muskegon. The company recently received a $40,000,000 contract increase for additional machinery and equipment there. Packard has cooperated by turning over necessary engineering and shop information to Continental.

Nash Motors Div. of Nash-Kelvinator Corp. is the latest automotive firm to get into quantity production of aircraft engines. Nash is manufacturing the Pratt & Whitney 18-cyl., 2,000-hp. Double Wasp engine with a two-stage mechanical supercharger. This is basically the same engine that Ford is making at the Rouge plant, except that the Ford-built Double Wasp has a turbo-supercharger and goes into Army Air Force planes. Nash-built Double Wasp engines are installed in the Navy's Grumman Hellcat and Vought Corsair fighter planes. Nash originally was scheduled to produce Pratt & Whitney engine parts at Lansing, Mich., but when another engine manufacturer was needed, Nash took over the job and converted some of its automotive plant space at Kenosha and Milwaukee, Wis., for the purpose. The first pilot engine was produced Oct. 31, 1942 and volume output got under way in February, 1943.

The gray iron automotive foundry at Kenosha was converted to the casting of aluminum cylinder heads, the first aluminum castings being turned out in May, 1943. Castings are poured on the old cylinder block casting conveyor. Space formerly devoted to machining and assembly of transmissions is occupied by heat treat furnaces, some of which were installed in pits to obviate the need for raising the roof. Many of the parts machining and finishing operations are installed in the plant area that formerly housed the frame and chassis assembly lines. Ten and one-half acres of new concrete floor was poured to accomodate the many new machine tools required. Machining of small parts and the three-piece crankshaft, hand polishing operations on the master connecting rod, which costs more than a complete automobile engine, and manufacture of some of the

(*Turn to page 52, please*)

M-8 Motorized Gun Carrier

This Cadillac built Army weapon carries a 75 mm. howitzer and a 50-caliber anti-aircraft machine gun. It is powered with two Cadillac V-type, 8-cylinder, 90-degree engines, and has two Cadillac Hydra-Matic transmissions.

No Comment on Whiteside Proposal

So far, only negative reaction has resulted among leading automobile manufacturers from the proposal of Arthur D. Whiteside, WPB civilian requirements vice-chairman, that industry controls be maintained for three years after the end of the European war to ensure every producer of automobiles an equal opportunity at the start of competitive production. Comment is withheld, according to one authoritative source, because, for one reason, the industry cannot at this time hope to essay the chances for resuming civilian production with its limited knowledge of how the war situation stands and the extent of future demand for war production. Furthermore, it is pointed out that Donald Nelson, following his meeting with 15 leading industrialists, among whom were representatives of the automobile manufacturers, made it quite clear that civilian production can be planned for now only so far as it will not take manpower from the war effort.

According to the Whiteside suggestion, each automobile manufacturing company would be permitted to make as many cars in the three-year period following the European war as it made in 1941, but could make its quota at any time during the three-year period.

National Service Legislation Not Thought Answer to Manpower Problems

Unions Oppose Service Law, Not Much Comment from Industrial Leaders. Strikes by Foremen Continue

National service legislation as suggested by President Roosevelt in his message to Congress Jan. 5 finds neither labor nor management in the automotive industry very much in sympathy with the proposal. R. J. Thomas, president of the UAW-CIO, is outspoken in his opposition to a national service law.

"I do not believe it is necessary in a democracy in war or peace," says Thomas. "I have not changed my view that free labor can defeat slave labor any time. Great numbers of our war workers are now being laid off. Others are denied full employment. Certainly, if any attempt is made to conscript labor, it is only fair, at the same time, to provide that all Americans ready and willing to work are given a guarantee of a weekly wage. Hoarding of labor, lack of transportation and housing facilities, gross inequalities of wages for similar work—these are some of our manpower problems. None of them will be solved by attempting to conscript American workers."

C. E. Wilson, president of General Motors, did not comment on the President's proposal but in the past he has opposed the drafting of labor. He maintains that men cannot be transferred like machines due to the human element. He believes in minimum restrictions upon the individual in order to derive the most efficient work and obtain the best efforts from him. Other industry leaders point to the Smith-Connally Act in its failure to reduce strikes by the mere passing of legislation.

Strikes by supervisory employes continue to plague the automotive industry. For more than a year the Foreman's Association of America has been endeavoring to obtain recognition as bargaining agent for foremen in automotive plants. Most recent victim of the FAA drive was the Chrysler Corp., which had foremen in five plants walk out over a week's period. Eight hundred and sixty out of 1275 foremen in the Dodge Truck and Main plants, two DeSoto plants and the Detroit Tank Arsenal went on strike at daily intervals after the walkout was precipitated by demotion of a foreman for alleged incompetence.

Chrysler recently was party to a case before the National WLB, along with Murray Corp. of American, Briggs Mfg. Co. and Packard, in a dispute in which the FAA sought bargaining rights in automotive plants. The companies have held that an NLRB decision of last May 11 prevents them from recognizing unions of supervisory employes as bargaining agents. However, the FAA contends that in the Maryland Drydock Co. case the NLRB ruled that shipyard workers and supervisors could not belong to the same CIO union, while the FAA is independent of national unions like the AFL and CIO. The FAA also asserts that foremen are caught between organized labor on the plant floor and management, and have no opportunity to present their own grievances. In the Chrysler dispute, the FAA charged the company with setting up a double standard between supervisory and production employes and said that the former worked up to 1100 hours overtime without compensation. War production in Chrysler plants was slowed down materially.

General Motors economists contended that the wage demands presented on behalf of its 300,000 members in GM plants by the UAW-CIO would cost between $407,000,000 and $528,000,000 in hearings before a three-man WLB fact-finding panel at Detroit. The costs were figured at $50,000,000 for a cost-of-living bonus, up to $300,000,000 for a $1 an hour minimum and industry-wide wage agreement, up to $28,000,000 for a 10 per cent night shift bonus, up to $35,000,000 for a 12-day annual sick leave and up to $115,000,000 for a post-war reserve fund for GM workers. Walter Reuther, head of the GM department of the UAW-CIO, charged that the GM figures were designed to cover up the fact that the corporation is lining its pockets with heavy wartime profits, which GM denied.

Commenting on the union's wage demands, the GM brief said, "They present a picture of contradiction and confusion. . . . The only consistent element in the union wage demands is that they all ask for more money for doing the same, or less, war work." The corporation also said that in many communities GM wage rates have been protested by other employers on the ground that they lead to dissatisfaction among employes performing comparable work. GM spokesmen asserted that the union's 29 demands all would raise the cost of GM's war production, while the corporation's seven demands all are aimed at increasing the effectiveness of war production and reducing the man-hours required. Members of the fact-finding panel are Ralph Ziegler, publisher of the Detroit Legal Record, chairman; Walter White, Dept. of Commerce official, representing industry, and James Carey, National CIO secretary, representing labor. When these hearings, which began early in January, conclude, the panel will present its report to the National WLB.

In its drive for an industry-wide wage agreement on the basis of equal pay for equal work, the UAW-CIO executive board has set up six subdivisions which will study wage data and statistics in the following sectors of the automotive-aircraft industry: (1) tank production, heavy mechanized units, trucks and jeeps; (2) Aircraft, automotive, truck and Diesel engine production; (3) wing and fuselage fabrication and assembly; (4) guns, shells and general ordnance; (5) forges and foundries; (6) tool and die, patternmakers, maintenance and related skilled trades. This program is designed to wipe out wage differentials between different sections of the country, presumably raising wages in each bracket to the highest rate prevailing in that bracket. The union also is seeking an escalator clause in new wage contracts to tie wages to the cost of living, a 48-hour guaranteed work week or 48-hour guaranteed weekly wage, creation of a post-war employment security fund, provision for severance pay, a $1 per hour minimum and provisions for a guaranteed annual wage.

Two unusual instances of disciplining recalcitrant members were demonstrated by CIO unions recently. The United Rubber Workers revoked the membership of 72 of its members who engaged in a wildcat strike at the General Tire & Rubber Co., Akron, holding up military truck and airplane tire production.

High Production at Grumman and Douglas

Grumman Aircraft Engineering Corp. turned out 653 planes in November for an all-time record. This was more than 7 per cent of the month's national total and an average of more than 21 planes daily. Grumman has delivered 7982 combat planes to the Navy over a two-year period. Grumman produces the F-4-F Wildcat and F-6-F Hellcat fighter planes and the TB-F Avenger torpedo bomber.

Douglas Aircraft Co., Inc., delivered 96,446,000 lb of combat aircraft in 1943 valued at more than $1 billion, according to R. V. Hunt, vice-president. Douglas manufactures two and four-engine bombers, two and four-engine cargo planes and Navy dive bombers. Last November Douglas produced the 5000th SB-D Dauntless dive bomber at its El Segundo, Cal., plant. It also operates plants at Long Beach and Daggett, Cal.; Tulsa and Oklahoma City, Okla., and Chicago.

Consolidated Vultee Sets Production Record

National production figures for the aircraft industry for 1943, compiled by the War Production Board, show that Consolidated Vultee Aircraft Corporation is the world's largest producer of airplanes. This was revealed by Tom M. Girdler, chairman of the board, who said that the company in 1943 delivered more airplanes by number and by weight than any other manufacturer.

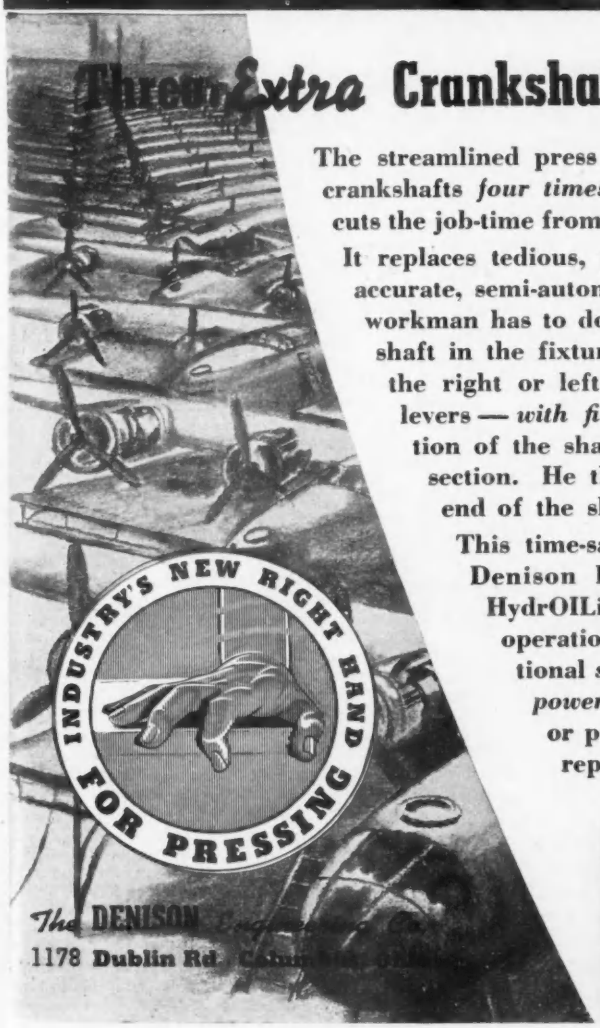
PRESSING NEW METHODS INTO SERVICE WITH INDUSTRY'S NEW RIGHT HAND

Three Extra Crankshafts Every Ten Minutes

The streamlined press shown above assembles airplane crankshafts *four times faster* than previous methods — cuts the job-time from *10* to 2½ minutes!

It replaces tedious, painstaking hand labor with quick, accurate, semi-automatic *oil hydraulic* operation. All the workman has to do now is lock the three sections of the shaft in the fixture, and direct hydraulic fluid to either the right or left ram. Then by moving ram-operating levers — *with fingertip pressure control* — one end section of the shaft is assembled to the rigidly held center section. He then repeats the operation on the opposite end of the shaft.

This time-saving equipment is a good example of how Denison Engineers are tailoring the advantages of HydrOILics to a constantly expanding field of industrial operations. They will be glad to show you how the exceptional *smoothness, flexibility and accuracy* of oil hydraulic *power, speed, and control* can be applied to your products or production. Write or wire today, or call your Denison representative.



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EQUIPMENT *in* APPLIED
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TRADE-MARK

WPB and OPA Orders Reflect Desire to Cut Regulations

Lightening of Restrictions Does Not Indicate, However, That Lifting of Metal Controls Is "Just Around the Corner"

By W. C. Hirsch

More and more does the daily grist of WPB and OPA orders reflect the desire to whittle down restrictive regulation without going so far as to encourage the impression gaining ground that a lifting of control over metals was just around the corner. Such gradual lightening of wartime procedure is easier to apply to minor transactions in most non-ferrous metals than to steel, where approach immediately is translated into speculation as to when transition to full-scale production for civilian needs may be resumed. Steel producers understand very well the official attitude that at this stage of the war's progress the door must not be closed to quick reinstatement of total war production, should that become necessary, but they believe that this can be assured while a start is made on diverting larger tonnages to non-military distribution. To some extent the steel industry's continuing controversy with union labor acts as a brake on what, it is thought, would otherwise be a more energetic approach of this problem. While no one dissents from the generally accepted fact that the steel industry is in a position to supply a greater amount of ingot steel than is called for by the war effort, finishing plants for the most part are operating nip and tuck with their capacity. Taking into account what additional facilities will be completed during this year's first half, output of flat rolled steels in that period is not expected to exceed orders now on mills' books plus what material will be called for in the second quarter.

A recent survey of what will be available in the near-by supply of hard-facing materials by WPB discloses a generally comfortable situation in cobalt, chromium, tungsten, nickel, molybdenum, vanadium, and secondary aluminum. There has also been further relaxation of regulations governing the use of alloy steel scrap, low-alloy scrap now being allowed for use in carbon steel. Orders governing the allocation and use of magnesium and magnesium products and the segregation and disposal of magnesium scrap have been greatly simplified by WPB, which in a recent directive also authorized the Aircraft Scheduling Unit of the Aircraft Resources Control Board to grant specific authorizations to deliver magnesium products going into aircraft and aircraft equipment. Formerly such authority was granted by WPB Aluminum and Magnesium Division on recommendation of ASU.

New York representatives of Bolivian tin shippers say that there has been no interruption of the flow of concentrates to the U. S. Government smelter, but future price arrangements are still the subject of discussion with Bolivian interests. American correspondents in China have recently referred to the complete cessation of tin mining in that country. A part of the tin that used to be referred to in the New York market as Chinese was really Siamese, but some tin of Chinese origin did formerly reach the American market. It is understood that cessation of shipments resulted from the abnormal rise in the value of Chinese currency in terms of the American dollar. With Bolivia and the Belgian Congo now the only sources of tin supplies, additions from China, no matter how small, would contribute materially to the easing of the situation.

Obituary

O. J. Beaudette, 80, pioneer body builder in the automobile industry, died Jan. 5 at Pontiac, Mich., after a short illness. He came to Pontiac in 1885 to become superintendent, partner and then owner of the W. F. Stewart Buggy Co. Later he converted his plant to the manufacture of automobile bodies and by 1909 was supplying bodies to Oldsmobile, Oakland, Studebaker, Ford and the Jackson Motor Co. The name was changed to the O. J. Beaudette Body Co. and in 1922, when it was sold to the Fisher Body Co., it had a capacity of 2000 bodies daily. This then became the Fisher Body Pontiac Division.

Dr. James T. Pardee, 76, one of the founders and former board chairman of Dow Chemical Co., died Jan. 3 at his home in Midland, Mich. With Dr. Herbert H. Dow he founded the Dow Process Co. in 1895 and the Dow Chemical Co. in 1897. He served as vice-president and secretary of the latter company for 40 years and was board chairman for six years until he retired in 1941.

George O. Wilcox, 47, former advertising executive on truck accounts, died suddenly Jan. 5 at Toledo. He was formerly associated with Maxon, Inc., on the Reo account, the Stewart Motor Truck Co., D. P. Brother & Co., Inc., on the GMC Truck account and McCann-Erickson, Inc., on the Ford truck account.

J. Harry Harley, 64, one of the early production executives in the automobile industry, died Jan. 7 at Detroit after a short illness. He was superintendent of manufacturing for the Chalmers Motor Car Co. from 1910 to 1915. In 1923 he established an automobile parts manufacturing company in Detroit. He was an executive of Stevens-Walden, Inc., engaged in war work at the time of his death.

F. W. Cuffe, 49, head of educational activities for General Electric's aviation division at Schenectady, died suddenly in Cleveland, Ohio, recently.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

Somewhat reduced fluctuations of general business activity have been indicated in January. The seasonally adjusted index of *The New York Times* for the week ended Jan. 8 rose to 144.1, as against 141.8 in the preceding week and 134.7 a year ago.

Department store sales during the first week of the month, as reported by the Federal Reserve Board, increased from 105 to 135 per cent of the 1935-39 average. Total values recorded were 3 per cent below the corresponding figure in 1943, and sales for the four weeks ended Jan. 1 were 7 per cent below the total a year earlier.

Railway freight loadings during the week ended Jan. 8 totaled 762,999 cars, 18.6 per cent more than the preceding weekly figure and 6.4 per cent above the comparable number in 1943.

Average daily production of electric power during the same period declined; but the total was 15.6 per cent above the output a year ago, as against a similar excess of 14.7 per cent recorded a week earlier.

Crude oil production in the week ended Jan. 1 continued a decline from the peak rate registered in the second week of November. Output averaged 4,357,300 barrels daily, 5200 barrels below the figure for the week before and 67,800 barrels less than the average recommended by the Petroleum Admnistration for War.

Production of soft coal during the same period was estimated at 10,500,000 net tons, 10.3 per cent above the preceding weekly figure and 12.9 per cent greater than the output a year earlier. Total production in 1943 was 1.6 per cent above that in 1942.

Engineering construction contracts awarded during the week ended Jan. 6 totaled $21,597,000, as against $28,180,000 a week earlier and $63,928,000 a year ago—according to *Engineering News-Record*. Contracts for public projects were 75 per cent below the comparable amount in 1943, while private construction registered an advance of 40 per cent.

Professor Fisher's index of wholesale commodity prices for the week ended Jan. 14 rose one fractional point to 112.4 per cent of the 1926 average, as compared with 110.1 a year ago.

Member bank reserves increased $199,000,000 during the week ended Jan. 12, and excess reserves rose $160,000,000 to an estimated total of $1,130,000,000. Business loans of reporting members increased $25,000,000 in the same period and stood $177,000,000 above the total a year earlier.

How can machine tools avenge this

Dunkerque in Arkansas?

This is no enemy propaganda. No "usually well-informed sources" or Berlin broadcasts tell this tale. This is real . . . this is here . . . and this is defeat.

Our own private *peacetime* Dunkerque — in Arkansas, in New York, in West Virginia or California — in countless American "homes" where millions of people are ill-housed, ill-clothed, and bodily and mentally ill-fed.

What part will machine tools play in turning this kind of defeat into victory? The *whole* part, if the men of industry have the vision and the freedom to plan ahead, and to carry out what they plan.

If you are a manufacturer, there is one thing you can do at once: Have your production men and planners consult now with the engineers of the leading basic machine tool producers. They can help you in planning today your part in the peace that must be won after the war is won.

One of these is a Bryant man. . . . We invite you to send for him.

BRYANT CHUCKING GRINDER COMPANY SPRINGFIELD VERMONT, U. S. A.

Factory-Dealer Relations Still a Subject for Legislative Discussion

Although the manufacture of passenger cars for civilians has been suspended for two years and only approximately half a million new cars have been sold under rationing during that period, the old perplexing problem of factory-dealer relations still is a subject for legislative discussion as well as for academic argument by automobile trade association executives. Despite the fact that it is difficult to forecast what lies ahead in the way of restrictive legislation for the automobile manufacturers, the field relations department of the AMA has recently transferred its activities from Washington back to Detroit. Earlier in the war the department carried on as part of the Automotive Safety Foundation in Washington, concentrating chiefly on the problem of varying truck load, weight, height and length regulations between states, leading to the tying up of vital war material in transit on the highways. The field relations department helped ODT in gaining adoption of the war-time emergency standards which have brought some degree of uniformity in size and weight specifications for trucks in interstate commerce. Now it has returned to Detroit to be close to the distribution organizations of the automobile companies.

The old function of analyzing field problems, especially in the legislative field, as they apply to dealer relations is not dormant despite the war. Two states, New York and Illinois, passed bills in 1943 denying the right of automobile manufacturers to disfranchise their dealers without a hearing but in each case the bill was vetoed by the governor. The Illinois bill was passed by both houses of the Illinois legislature with only one dissenting vote. It was sponsored by the Automobile Trade Association of Peoria. It prohibited a manufacturer or distributor from terminating the contract of a dealer without "just, reasonable and lawful" cause, nor unless a hearing had been held before the secretary of state, if such a hearing was requested by the dealer. The secretary of state was instructed to take into consideration the circumstances of the termination, such as the amount of business transacted by the dealer, the amount and permanency of his investment, his obligations and the effect of the termination upon the public welfare. The bill also provided that the application of any person for a motor vehicle dealer's license in any territory where a dealer contract had been terminated without just, reasonable and lawful cause in the preceding 150 days would be denied.

Gov. Dwight Green vetoed the Illinois bill on the grounds that it was unconstitutional inasmuch as it violated the due process clause, was an unreasonable restraint upon business and tended to restrict the right of contract.

The New York dealer licensing bill passed both houses of the state legislature on the last day of the session. It provided that the commissioner of motor vehicles might deny the application of any dealer for a license if, after a hearing, it was determined that such a dealer had a contract with any distributor or manufacturer who, within six months of the date of the application, had terminated a contract with another dealer in the same county. It also provided that each application for a dealer's license must have a certified copy attached of the contract with the manufacturer or distributor. Gov. Thomas E. Dewey vetoed the bill without comment.

More than half of the states of the union have laws regulating relations between automobile manufacturers or distributors and dealers. Most have been passed with the avowed purpose of safeguarding the public interest in the automobile business. Wisconsin has one of the most restrictive of these laws, which was passed in 1935 and amended several times since then. A 1943 amendment transferred control over dealers, distributors and manufacturers from the state banking commissioner, where it first was placed through inclusion of finance companies, to the motor vehicle department. There are 17 valid reasons for denying, suspending or revoking a dealer or distributor license under the Wisconsin law.

Other restrictions upon manufacturers have been the state chain store taxes and anti-trust laws. Ford Motor Co. at present is engaged in litigation with the state of Texas over an attempt to regulate Ford dealerships under the Texas anti-trust laws. Texas holds that where goods are resold within Texas in a restricted territory, it is in violation of the state anti-trust laws. Ford won a case in the Colorado courts in 1940 when an attempt was made to subject Ford dealerships to the state chain store tax while gasoline stations were exempt. This was a significant case which was watched closely by the other 28 states having chain store taxes.

P-61 Is Newest Combat Plane

The P-61, a powerful night fighter, is the newest combat plane of the AAF, the War Department announced.

Called the Black Widow, it is the outgrowth of intensive research and development on the part of technicians of the AAF Material Command and of Northrop Aircraft, Inc., Hawthorne, Cal., directed toward production of a powerful and effective aerial night combat weapon equipped with the latest devices.

The Black Widow is heavily armored and armed. It is powered by two Pratt and Whitney engines.

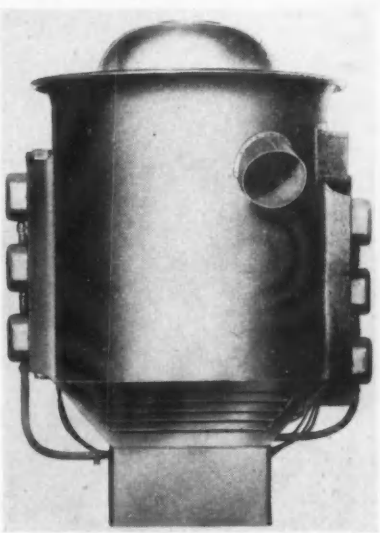
Details of the P-61's performance remain secret. However, it is described as having fairly long range and possessing effective speed and climb characteristics.

ARMY E NAVY

Awards

Names and winners of Army-Navy "E" awards in or allied with the automotive and aviation industries, announced since the Jan. 15 issue of AUTOMOTIVE AND AVIATION INDUSTRIES went to press.

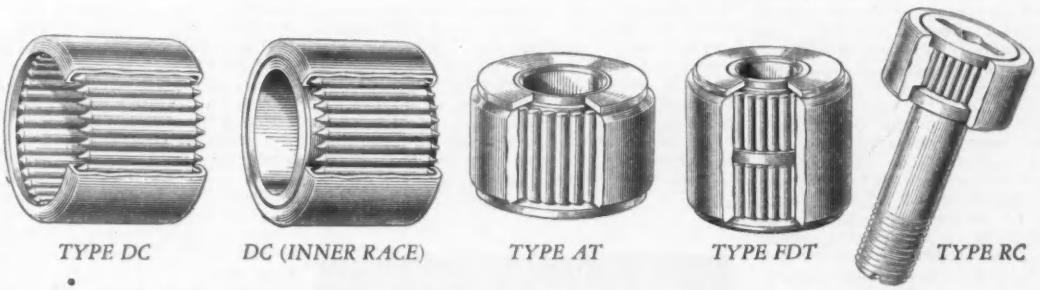
L. F. GRAMMES & SONS, INC., Allentown, Pa.
HERCULES POWDER COMPANY, Brunswick Plant, Brunswick, Ga.
KERMATH MANUFACTURING COMPANY, Detroit, Mich.
McCABE POWERS AUTO BODY COMPANY, St. Louis, Mo.
MOORE DROP FORGING COMPANY (three plants).
RAYBESTOS MANHATTAN, INC., Manheim, Pa.
SQUARE D COMPANY, Kollsman Inst. Div., Suffern, N. Y.
UNITED STATES RUBBER COMPANY, Woonsocket Plant, Woonsocket, R. I.
WILLARD STORAGE BATTERY COMPANY, Cleveland Plant, Cleveland, Ohio.
THE YOUNGSTOWN SHEET & TUBE COMPANY, Chicago Dist. Wks., East Chicago, Ind.



Helicopter Engine

This Franklin 6-cylinder, opposed, aircooled engine, built by Aircooled Motors Corp., Syracuse, N. Y., is in service in several experimental helicopters. Cooling is accomplished by an engine driven fan, covered by a large housing, which also conceals a clutch mechanism serving to disengage the engine from the rotor.

These Needle Bearings ALL Have High Unit Capacity!



TYPE DC *DC (INNER RACE)* *TYPE AT* *TYPE FDT* *TYPE RC*

HIGH LOAD RATING IN PROPORTION TO SIZE AND WEIGHT IS IMPORTANT DESIGN FEATURE

As new applications have developed requiring a small size, lightweight, high capacity, anti-friction bearing, modifications have been made in the original Torrington Needle Bearing design until today a full line with a wide range of types and sizes is available.

All of these Needle Bearings offer the outstanding advantage of high unit capacity.

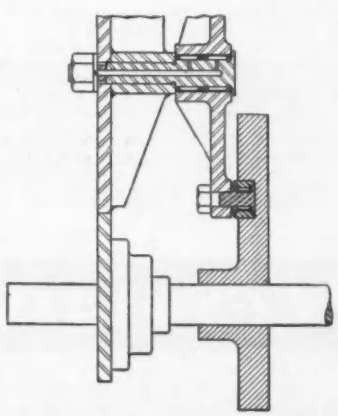
Their high radial load-carrying capacity is due to their basic design principle: A full complement of small diameter needle rollers held within a retaining raceway to form a single compact unit. Thus, in small space, more than double the "line contact" is provided than in other radial roller bearing types.

Weight distribution within the bearing's "load zone" is spread over a larger "area" and danger of stress concentration on races or rollers is consequently reduced.

"Heavy Duty" Types

Many of the newer types of Torrington Needle Bearings have been designed to utilize the full non-Brinell capacity available. For example, the FT Type is provided with a permanently attached inner race, hardened to a depth to carry the rated load of the bearing. The outer race is heavier and designed to serve without an auxiliary housing if desired.

Similarly, other RC Types for use primarily in the application of Needle Bearings as cam followers, have a heavy outer raceway and are designed for heavy rolling loads. Maximum static non-Brinell capacities extend from 1,410 to 133,600 pounds which provide the design engineer with a wide range in bearing selection. The Torrington Engineering Department should be consulted for capacity under rolling loads. Additional information will be found in our Catalog No. 107, available on request.



Application of the Type RC Needle Bearing in cam follower service and two DC Needle Bearings on rocker shaft are shown in this cross-section of a package sealing machine.

A Unique Combination of Advantages

All types of Torrington Needle Bearings offer the same outstanding advantages which gave the original unit such immediate and widespread acceptance. In addition to high capacity, they are small in size, light in weight. Their unit construction adapts them to mass production methods of assembly. They are easily and efficiently lubricated. And they are low in cost.

All these features are important in planning designs for today's needs and for "Tomorrow's" demands when reduced size, weight and cost will be important factors in contributing to increased production, distribution *and* operating efficiency. Our engineering staff will gladly work with you in selecting the Needle Bearing and in laying out applications.

THE TORRINGTON COMPANY

Established 1866 • Torrington, Conn. • South Bend 21, Ind.

"Makers of Needle Bearings and Needle Bearing Rollers"

New York Boston Philadelphia
Detroit Cleveland Seattle
San Francisco Chicago Los Angeles
Toronto London, England

LET'S GO! WAR SAVINGS BONDS AND STAMPS

TORRINGTON

NEEDLE BEARINGS

PUBLICATIONS

A new, 24-page, non-technical booklet covering all types of plastics, their uses and general information on the plastic industry has been released by the Richardson Co. The booklet is illustrated and explains the host of properties which fit **Insurok** and other plastics to the wide range of present and postwar uses. The limitations of plastics are also covered. The two main groupings of plastics, **Thermosetting** and **Thermoplastic,** are described and illustrated in layman's language. Special sections are devoted to the forms of plastics, laminated and molded. The manufacturing and production processes of each are well illustrated.•

A vest-pocket handy guide to top performance in steel cutting with **carbides** has been issued by Carboloy Co. The booklet covers the characteristics of different grades of carbides designed for steel cutting, selection of proper rake and relief angles, etc. Machine requirements, speeds and feeds are given, together with grades recommended for different classes of steels. Design and grinding of chip breakers is included, as is the problem of supplying coolant in proper amounts and properly directed.•

L. J. Kaufman Mfg. Co. has issued a 4-page bulletin on **Kaufman Hi-Duty** tapping machines. Pictures of the single and dual spindle tappers, special machines and fixtures are included, along with specifications, principle of operation and special features of the tapping machines.•

The third in a series of heat treating sales bulletins has been issued by G. S. Rogers & Co. It is **Heating and Special Purposes.**•

A new 32-page booklet, **Powder Metallurgy,** on powdered metal parts, has been published by Keystone Carbon Co., Inc. Types of design and specifications for standard forms as well as intricate shapes are presented in detail. A section of the booklet is devoted to Selflube Porous Bronze bearings, Selflube Porous Iron Bearing and D-10 Graphite Impregnated Brass Bearings.•

The fundamentals and the various applications of **electronic control** are illustrated and described in a new 12-page bulletin recently issued by General Electric Co. It explains the fundamental principles of electronic tubes and their operation, describes the construction of the well known thyratron tube, and lists the functions of eight of the more widely used industrial-type tubes.

The G-E **turbosupercharger,** a new 32-page bulletin issued by General Electric Co., is the latest addition to a series describing the company's history, its research activities and its contributions to American progress.•

The Emerson Electric Mfg. Co. has issued a new booklet on the **Emerson-Electric Motors on the Air Front.** The booklet is well illustrated, contains many dimensional drawings and several pages of specifications.•

A new and comprehensive illustrated **arc welding inspection chart,** designed so that operators and inspectors can tell at a glance whether welds are being properly made, has been published by the Lincoln Electric Co. It pictures actual specimens of various results obtained in maknig fillet and butt welds. A portion of the chart is devoted to a description of the widely used Fleet-Fillet welding technique, telling of its advantages, where and how to use, and including a table on the procedure for single-pass horizontal and positioned fillets with Fleetweld II, which carries data such as electrode sizes, desired current, etc.•

The story of **Zinc Borate-3167,** including its physical and chemical properties, is told in a new booklet recently issued by the New Jersey Zinc Co.•

Pressurized Power & Controlled Flow by Pesco is the title of an attractive new booklet issued by Pesco Products Co. It contains interesting and informative material for design engineers and presents, pictorially, the extensive engineering and experimental laboratory services as well as the Precision production facilities of Pesco.•

Behr-Manning, Division of Norton Co., has issued a new booklet, **Basic Information for the User and Buyer,** which is a down-to-earth discussion of Coated Abrasives, their component parts, manufacture and their ultimate use. Included is information on how to identify, order and store sandpaper.•

Firestone Tire & Rubber Co. has issued an attractive booklet, **Producing For War and Preparing for Peace.** It contains the story of synthetic rubber and includes a chapter on Producing for War, and one Preparing for Peace.•

A. B. Farquhar Co. has a new catalog showing its complete line of **hydraulic presses,** with specifications, photographs of actual installations and thumb nail sketches on each page to illustrate potential uses for postwar work.•

CALENDAR

Conventions and Meetings

American Society of Heating and Ventilating Engineers — 50th Anniversary Meeting—New York City, Jan. 31-Feb. 2

American Society for Testing Materials Spring Meeting, Cincinnati, Feb. 28-March 3

American Society of Tool Engineers—Annual Mtg., Philadelphia. March 26-28

American Chemical Society Spring Mtg. of Div. of Rubber Chemistry, New York City April 26-28

Institute of the Aeronautical Sciences—Natl. Light Aircraft Mtg., Detroit, April 27

American Society for Testing Materials (47th Annual Meeting), New York City June 26-30

PERSONALS

Waukesha Motor Co. has announced the advancement of **Lowell F. Whisler** to become manager of purchases and expediting, and **Glenn R. Evans** to the post of production manager.

Announcement has been made of the appointment of **W. Paul Eddy, Jr.,** as materials engineer, Pratt & Whitney Aircraft Div., United Aircraft Corp. He was formerly associated with General Motors Corp.

The appointment of **James H. Jewell** as assistant manager of Industry Depts. has been announced by the Westinghouse Electric and Mfg. Co. He will continue to head the Agency and Specialties Dept.

The following personnel announcements have been made by Adel Precision Products Corp.: **Raymond J. Kirby** is special research and development engineer on hydraulic and pumping equipment. **Wing Commander J. G. Goodenough** will head the new diesel and engine equipment division.

Dr. Charles A. Getz, director of the research div. of Cardox Corp., has been elected to fill the newly created position of vice-president in charge of research.

Wright Aeronautical Corp. has announced the following personnel changes: **K. E. Sutton,** associated with the company since 1929, has been named manager of the Wood-Ridge (N. J.) warplane engine plant. **A. M. Scheerer,** experimental engineer with the company for the past 8 years, has been appointed engineering manager at the Wood-Ridge plant.

Burd Piston Ring Co. has announced the transfer of **A. A. Lundgren** to California to take over the general supervision of the company's business in the Pacific Coast area.

The appointment of **William A. Foote** to be sales coordinator of Littelfuse, Inc., El Monte, California and Chicago, has been announced.

Goodyear Aircraft Corp., subsidiary of Goodyear Tire & Rubber Co., has announced the promotion of **Thomas A. Knowles** as a vice-president.

Hugh M. Fenwick has joined Curtiss-Wright Corp. He was formerly assistant to the executive vice-president of Consolidated-Vultee Aircraft Corp.

The Pennsylvania Salt Co. has announced the retirement of **North Emory Bartlett** as vice-president. **L. H. Brandt,** formerly with the National Ammonia Div. of duPont, has joined the Technical Service Dept. of the Pennsylvania Salt Co.

John Taylor Floyd, Jr., has been named acting traffic manager of TACA Airways System.

Acme White Lead and Color Works has announced the appointment of two new executives. **Michael J. Fortier** will succeed the late Clarence A. Campbell as vice-president and general manager, and **Fred J. Squires** is treasurer, succeeding the late Roy H. Stephens.

The election of **B. C. Gould** as vice-president of Murray Corp. of America and member of the board of directors has been announced.

The appointment of **Louis Malcolm Edgar** as exclusive sales and engineering representative for the Kelly Reamer Co. for the State of Michigan has been announced.

Announcement has been made of the appointment of **Joseph F. Sloate** as manager of Personnel of The General Tire & Rubber Co.

Wickwire Spencer Steel Co. has announced the appointment of **Lt. Col. Cecil P. Young, U.S.A. Ret.,** as executive vice-president of the Wickwire Spencer Aviation Corp., a subsidiary of Wickwire Spencer Steel.

The following announcements have been made by The Timken Roller Bearing Co.: **A. M. Donze,** for the past 8 years factory manager of the company, has become vice-president in charge of production. **John E. Fick,** superintendent of the Steel and Tube Div. of the company, has been made vice-president in charge of that div.

W. S. Richardson, general manager of the chemicals div. of The B. F. Goodrich Co., has been elected vice-president of the Hycar Chemical Co., in addition to his duties with the Goodrich company.

George Russell has been appointed assistant treasurer of General Motors Corp. with headquarters in New York, and **Roy E. Hammond** has been made assistant comptroller, with headquarters in Detroit, according to a company announcement.

Harry M. Ramsay has resumed the position of assistant sales manager of Fisk Tire div. of United States Rubber Co., it has been announced.

Edward F. Love, vice-president of the Chase National Bank, was elected a director of Willys-Overland Motors, Inc.

C. H. Bennum has been made assistant sales manager of Aircooled Motors Corp., according to an announcement made by the company.

Henry Rowold has been elected vice-president of Mack-International Motor Truck Corp.

K. C. Plasterer, formerly standards engineer, has been appointed general manager of the Oldsmobile shell plant at Kansas City. He succeeds **Maynard T. Murray,** who has been placed in charge of Oldsmobile's shot and shell production at Lansing. **Russell Trapnell,** formerly chief inspector at the Kansas City plant, has been made superintendent of Olds shell plant No. 1 at Lansing. **Paul M. Brackman,** formerly

There are many GOOD THINGS AHEAD . . .

Soybeans will certainly be one of the country's important crops in the future. A single acre of land devoted to them will produce about seven times as much protein as it would if planted to corn for the feeding of hogs.

The war has checked the spread of quick-freezing locker plants which were spreading across the country from the farming states at the rate of about fifty new plants each month. A million patrons are already withdrawing two million pounds of food from their lockers daily. Home-sized quick-freezing units will probably be combined with mechanical refrigerators in after-the-war models.

The fluorescent tube may have many uses besides those already familiar. Inks that show under ultra-violet light are already in use to mark laundry, and are being tried out in hospitals for the identification of babies. Fluorescent materials help in the detection of theft and sabotage, and in the detection of altered documents. Fluorescent lighting distinguishes between butter and margarine, determines the freshness of eggs and nuts, or the adulteration of coffee, lard and olive oil. Experts can even tell, with its help, from what flowers a sample of honey has been made.

Powdered glass is being pressed into shapes and fused by heat in a manner similar to the technique used for powdered metals.

A machine is reported in which a photo-electric cell scans a drawing and operates a machine that produces the part shown in the drawing.

Cotton, laminated with thermo-setting plastics, is being tried as a substitute for sole leather . . . semi-flexible, water repellent, and similar in appearance to leather, but longer wearing.

New "rare-element" glass that contains no sand makes optical glass for camera lenses with twice the speed of any former lens.

A new method of cutting metal uses slightly worn band-saw blades run at approximately ten thousand feet per minute. The high speed of the saw actually melts the metal in its path.

Baking dishes can now be made of special paper that resists heat to 350 degrees.

The photo-electric cell (or electric eye) was first introduced to the public as an automatic door-opener. Now it sorts fruit, smoke and fire, levels elevators, records automobile speeds, counts pills, matches colors, sorts merchandise, turns on lights, measures machined parts, detects flaws in metal and is the heart of television. Its use has only begun.

Backyard gardeners will be pleased to know that experiments are being made with high-frequency currents to kill insect pests in the ground.

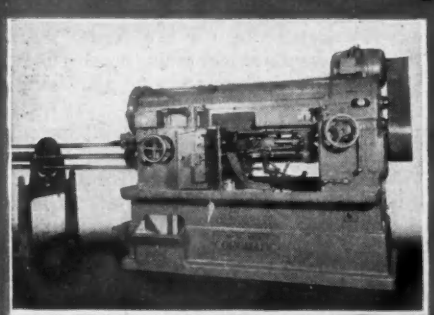
An immediate post-war demand is expected for two million one-hundred thousand automobiles, one-million five-hundred thousand mechanical refrigerators, one-million two-hundred thousand washing machines, one-million two-hundred thousand radios, nine-hundred thousand electric irons, and six-hundred thousand electric sewing machines.

The Basic Magnesium, Incorporated, plant near Boulder Dam, largest single electrical installation in the country, uses eighteen million dollars worth of silver in place of copper to carry its current.

A patent has been issued for a method of transcribing eight hours of continuous reading by variably magnetizing a spool of fine wire the size of an ordinary spool of cotton. With this wire in a radio-like machine, a housewife could attend to her domestic chores and listen to the reading of an entire book at the same time.

A new camera takes three million pictures in a single second.

If you are looking ahead you will be interested in production like this



This 4¼" bronze valve stem is produced on the 6-spindle Conomatic in nine seconds — nine seconds for eleven operations including four forming cuts, four cuts with roller turners, two threading operations and cutting off — all to close tolerances.

This is real production — the sort of production that is winning the war — the sort of production that you will need in your plant to meet competition when the war is over.

CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U. S. A.

assistant, will succeed Trapnell at Kansas City.

L. W. Klein, formerly vice-president and sales manager, has been elected executive vice-president of the Gabriel Co. **William H. Miller** has been elected a vice-president and director.

Kenneth F. Park has been appointed manager of the sales development division of Caterpillar Tractor Co.

Willard F. Rockwell, board chairman of Timken-Detroit Axle Co., has been elected a director of the First National Bank and the Peoples-Pittsburgh Truet Co., both of Pittsburgh.

Brig.-Gen. John K. Christmas, formerly assistant chief of the Detroit office, Chief of Ordnance (formerly the Tank-Automotive Center), has relinquished his duties to devote full time to expedite the supply of spare parts for tanks and military vehicles in the field. He will serve as special assistant to Brig.-Gen. W. P. Boatwright, commanding general of the Detroit office.

Edward C. Hoenicke, assistant to the general manager of the Eaton Mfg. Co. foundry division, has been named WPB consultant in charge of the new gray iron castings section.

Howard S. Welch, former vice-president and general manager of the Bendix Aviation Export Corp., has been named export sales manager of Sperry Gyroscope Co.

P. V. Moulder, formerly assistant to the second vice-president, has been appointed general manager of the newly created Motor Truck Division of International Harvester Co.

Dean C. Smith, formerly director of transport for the Airplane Division of Curtiss-Wright Corp., has joined the executive staff of Fairchild Engine & Airplane Corp., in charge of development activities.

George W. Mason, president of Nash-Kelvinator Corp., and B. E. Hutchinson, vice-president and chairman of the finance committee of Chrysler Corp., have been elected to the board of directors of the National Association of Manufacturers.

John S. Bugas, formerly head of the Detroit office of the FBI, has joined the Ford Motor Co. as an aide to Harry Bennett, personnel director.

W. A. Blume has been elected a vice-president of American Brake Shoe Co.

George Krieger, formerly chief engineer of the tractor and farm implement division of Ethyl Corp., Detroit, has been appointed deputy chairman of WPB. For the last 15 months he has served as director of the farm machinery and equipment division of WPB.

R. A. Hutchinson, formerly vice-president and general manager, has been named president of Studebaker Export Corp. He succeeds **Arvid L. Frank,** who has been in poor health for some time but expects to take up active duty as an export consultant for the corporation in the near future.

W. H. McAvoy Receives Octave Chanute Award

William H. McAvoy, chief test pilot of the National Advisory Committee for Aeronautics, received The Octave Chanute Award for 1943, according to an announcement by the Institute of the Aeronautical Sciences. This award, which is given annually for a notable contribution to the aeronautical sciences made by a pilot, was presented to Mr. McAvoy "for continuous service in the flight testing of experimental airplanes under hazardous conditions imposed in aeronautical research." It was presented at the Honors Night Dinner of the Institute held at the Waldorf-Astoria Hotel in New York on Jan. 24.

Aircraft Engine Output High

(*Continued from page* 43)

98 spur and bevel gears that go into each engine are among the jobs performed in this area.

Cylinder heads and pistons, articulating and master rods are machined at Nash's Seaman Body plant in Milwaukee, while crankcase sections are machined under subcontract by Gisholt Machine Co., in Madison, Wis.

The crankshaft is received as a one-piece forging, which is machined, heat treated and cut into three pieces, which are splined and reassembled prior to finishing and balancing. More than half of the rough forging weight of the crankshaft is removed in machining and finishing operations. Four large magnesium castings, including the supercharger housing and the crankcase sections, are among the parts machined in the magnesium machining department, which is a former shipping building in which the spur tracks were filled in. A new DPC plant houses the engine final assembly, teardown and reassembly operations, and this is adjoined by several dozen test cells, which are being augmented by some new construction.

Nash-Kelvinator's volume of war production in 1943 reached $500,000,000, according to President George Mason. In addition to aircraft engines, the company is making Hamilton Standard hydromatic propellers at three plants in Lansing at a rate 10 times that called for in the original contract. These propellers are installed on 25 types of planes used by the United Nations. The Grand Rapids plant expects to be in production by spring on the Sikorsky R-6 helicopter for the Army. Binoculars, airplane controls, bomb fuses, and propeller governors also are being produced.

December's output of military planes totaled 8,802, 13 more than November, bringing the aggregate for 1943 to 85,946 planes. This marked an increase of 80 per cent over 1942 output of 47,873 planes but fell short of the year's goal of 100,000 planes and a rate of 10,000 planes per month by December. Causes for this production deficit cited by government officials have been constant design changes to meet combat conditions, engine shortages, models still under development, maldistribution of raw materials, reorganization of plant layout, making up schedules on spares, and labor shortages. WPB schedules call for output of 145,000 military planes in the 15 months beginning with January, according to the report by Gen. H. H. Arnold to the War Dept. That is an average of more than 9,600 planes per month. Rapidity with which the Bell Bomber plant at Marietta, Ga., is going into production is one of the encouraging developments.

Ford's Willow Run bomber plant passed its fourth consecutive month ahead of schedule in December and now is the largest supplier of B-24 bomber to the AAF. It is producing several hundred bombers a month and nearing its projected peak, according to a Ford official. More than 2,000 B-24s have been turned out, five times as many being delivered in the fourth quarter of 1943 as in the first quarter.

BOOKS . . .

American industry is on the way to marking up a new technological triumph in the wake of achieving mass production of synthetic rubbers. With production of 750,000 tons of the artificial products coming up in 1944, the new problem of reclaiming used synthetic rubber articles on a large scale is being solved in U. S. factories and laboratories.

That's the report of rubber authority *Howard Wolf* in his new book, "THE STORY OF SCRAP RUBBER," just published by *A. Schulman Inc.*

In stressing the importance of reclaiming scrap synthetic, Mr. Wolf notes that as much reclaim as new natural rubber has figured in recent rubber goods manufacture, and that under normal peacetime conditions one pound of reclaim is used to every three pounds of new rubber.

Accounting for the lion's share of the current colossal synthetic program is the Buna-S type of synthetic rubber out of petroleum or alcohol and coal tar. The reclaiming of all-synthetic articles of this type, says Mr. Wolf, has been achieved by increasing pressures and temperatures required in the standard pre-synthetic reclaiming process.

This pressure and temperature variation means, however, that reclaimers are up against difficulties in regenerating rubber goods compounded of a mixture of buna and natural rubbers. Mr. Wolf presents this as the principal challenge still confronting reclaim researchers.

He reports that butyl rubber, second in the Government synthetic program, can be reclamied by giving it a long milling on a tight mill. Third in the program is neoprene synthetic rubber and the Wolf book records that neoprene reclaim has been used to a considerable extent during the past year in making rubber heels.

Wolf's volume, the first on scrap and reclaim rubber, traces the story of scrap from the beginning days of rubber in commerce right through its saving the rubber situation for the United Nations in the interval of waiting for enormous synthetic production to be brought in.

(*Turn to page* 156, *please*)

Predicting Tractor Bearing Life

(*Continued from page* 37)

With reference to item 2, a curve (Fig. 1) has been prepared from the data contained in the table. It is noteworthy that the points on this curve follow a definite pattern even though they were gathered from several different sources. This, in itself, constitutes a check on the accuracy and reliability of the data.

A second curve (Fig. 2), calculated

How to get

TOOLS THAT OPEN THE DOOR

to Increased Output Per Machine . . .

IN MOST PLANTS, machine and press speeds are continually checked. But still another way to get more output is to *make a study of machine shutdown time caused by premature tool failure.*

And your tool room is the place to *start* the job of eliminating much of the time spent repairing, regrinding or replacing tools.

In thousands of plants, Carpenter is helping to get at the *causes* of these delays. Through the Carpenter Matched Set Method a definite *system* is provided for picking the proper tool steel for each job.

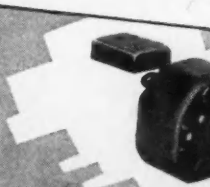
But Carpenter's aid to tool steel users includes more than help in the selection of the proper tool steel. For example, the Tool Steel Manual shown here can be used to simplify heat treatment and do a trouble-shooting job in your tool room. And of course, your nearby Carpenter representative is ready to give you the benefit of his diversified experience with tool steel problems. Get in touch with him.

Put this Printed Help to Work on Your Problems!

This 167-page Manual contains an 80-page Tool Index and Steel Selector, alphabetically indexed by kinds of tools. A flip of the pages guides you to the proper steel for each tool—and then you find simple and complete heat treating instructions. Free to tool steel users in the U. S. A.

The Carpenter Steel Co., 103 W. Bern St. Reading, Pa.

HOW THE MATCHED SET METHOD WORKS

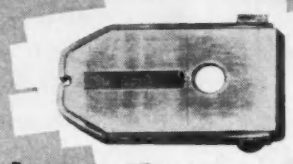


For Greater Toughness He Followed the Diagram

THE JOB: Piercing slots in 14 gauge hot-rolled steel—at 1,200 pieces per hour.

PROBLEM: The piercing die would break after about 2,500 pieces. Heat treatment and hardness were OK, so the Superintendent checked the Carpenter Matched Set Diagram for a steel with greater toughness. He found that *Carpenter R. D. S.* was the steel best suited for the job. And here are the results:

1. Tool life increased from 2,500 to 1,000,000 pieces.
2. Production up 39,400 pieces per month, by eliminating 33 hours of tool-caused idle press time.



Better Wear Resistance Gave Longer Tool Life!

THE TOOL: A cut-off blade for shearing ball bearing slugs.

PROBLEM: Tool life was too short, causing frequent replacement and much wasted time. A tool steel with maximum wear resistance was indicated.

SOLUTION: The solution was easy with the Matched Set Diagram on the job. The Tool Room Superintendent selected *Carpenter Hampden* for the job. And with *Hampden*, shutdown time decreased and production per tool was increased 30%.

Carpenter MATCHED TOOL STEELS

from the above curve and from general data, shows the percentage of motor torque required for average conditions plotted against the power-weight ratio in terms of horsepower per 100 lb of weight. Here again, it will be noted that the points follow a definite pattern.

To determine the bearing loads in a new tractor design, a preliminary check could be made by referring to the curve in Fig. 2. To use this curve, it is necessary to make an estimate of the weight of the proposed tractor in operating condition with water in the rear wheels, and to know the rated torque of the motor that will be used. From this information the power-weight ratio can be determined and the percentage of motor torque to be used in making preliminary calculations can be established. Knowing this torque, bearing loads at the various positions can be computed, tentative bearing selections made and anticipated life estimated. Since the torque given is that existent at the flywheel, suitable deductions should be made for gear efficiency depending on the number of gear meshes between the flywheel and the bearing being checked. An efficiency of 98.5 per cent can be assumed at each gear mesh. As a final check on the bearings, it is recommended that the curve in Fig. 1 be consulted since it gives a more accurate picture of normal conditions in each speed.

As a typical example of the use of the curve in Fig. 1, let us assume a proposed tractor has a gross weight with operator, etc., of 3000 lb. It has 9-32 tires with a 23 in. rolling radius and speeds as follows: Low gear—2¾ mph; second gear—3½ mph; third gear—4¾ mph; and fourth gear—6 mph. From the curve, the normal tangential force on the rear wheels in low gear will be 51 per cent of the weight, in second gear—42 per cent, in third gear—32 per cent and in fourth gear — 25 per cent. Translated to pounds, the tangential force will be—1530, 1275, 960 and 750 lb, respectively. The rear axle torque will be—35,200, 29,300, 22,000 and 17,200 lb-in., respectively. From these torque values, the bearing loads can be computed and the life factors determined. The weighted life can then be established for each bearing by means of the formula previously given.

In practice, it is the custom to first check all the bearings in low gear. In most cases, this will give the maximum bearing loads at all positions. It may then be found that many of the bearings are lightly loaded, the bearing selections having been dictated by the required shaft size. There is obviously no need of checking these bearings in the other gears where the loads will be lighter. Where load, and not shaft size, has been the determining factor in the selection of the bearings, a check of the loadings in the other speeds should be made. In this case, it is usually desirable to check several different sizes of bearings for each position and the life of each. Knowing the life and cost of each selection, the engineer can make a final selection, weighing one factor against another.

It must be emphasized that the foregoing data and suggestions with regard to the selection of tractor bearings apply only when the wheels are equipped with pneumatic tires. No attempt has been made to accumulate similar data for steel-wheeled tractors. However, it is generally agreed that to produce comparable draw-bar pull, a steel-wheeled tractor requires from 20 to 30 per cent more power than a pneumatic-tired one. However, it does not follow that the data and curves previously discussed can be used by adjustment of the individual values according to these percentages.

This study has been based largely on the smaller general purpose tractors where economy in bearing selection is of paramount importance. It is indicated, however, that the "tangential force on the rear wheels-weight ratio" shown in Fig. 1 holds true for larger models with a slightly different distribution of time in various speeds.

The data throughout apply only to bearings which are loaded in draw-bar work. Bearings loaded in power-take-off or belt-pulley work must be checked on some other basis.

● In Summer or Winter . . . in war or peace . . . with new models or old models revised . . . we believe Dole Thermostats will continue to regulate motor temperatures for maximum operating efficiency—saving gas, oil and the motor.

THERMOSTATS
and Leak-proof Primers
by the DOLE valve company
Devoting Production Facilities Almost Entirely to War Necessities
1901-41 Carroll Ave., Chicago, Ill.
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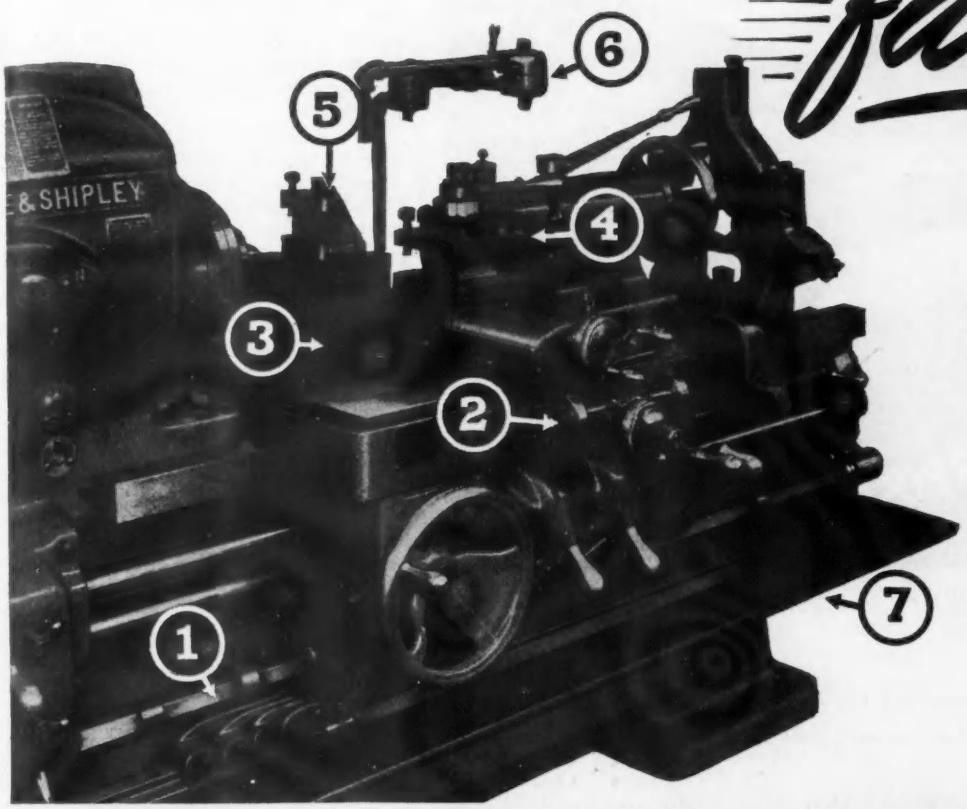
Produce SMALL Lots *faster*



LATHES GOOD LATHES ONLY
SINCE 1892

ARMY E NAVY

Original Navy "E"
Awarded March 6, 1942

Why you save time with The Lodge & Shipley Manufacturing Lathe

Change over quickly and easily from one job to another.
Advantageous use of multiple tools and universal holders.
Transfer of diameter and length control from operator to lathe.

OUTSTANDING FEATURES

(1) Multiple Length stops (Telescopic Dog Type), automatically disengage longitudinal feeds.

(2) Multiple Diameter Stops, for both front and rear tools, can be quickly indexed for establishing diameters. Time wasting "cut and try" eliminated.

(3) Connected rear rest increases tooling possibilities. Adaptable to single or multiple tools.

(4) Four-way tool block on compound rest can be indexed for twelve equally spaced tool positions.

(5) High duty tool block in rear used for single tool can be supplemented or replaced with multiple holder.

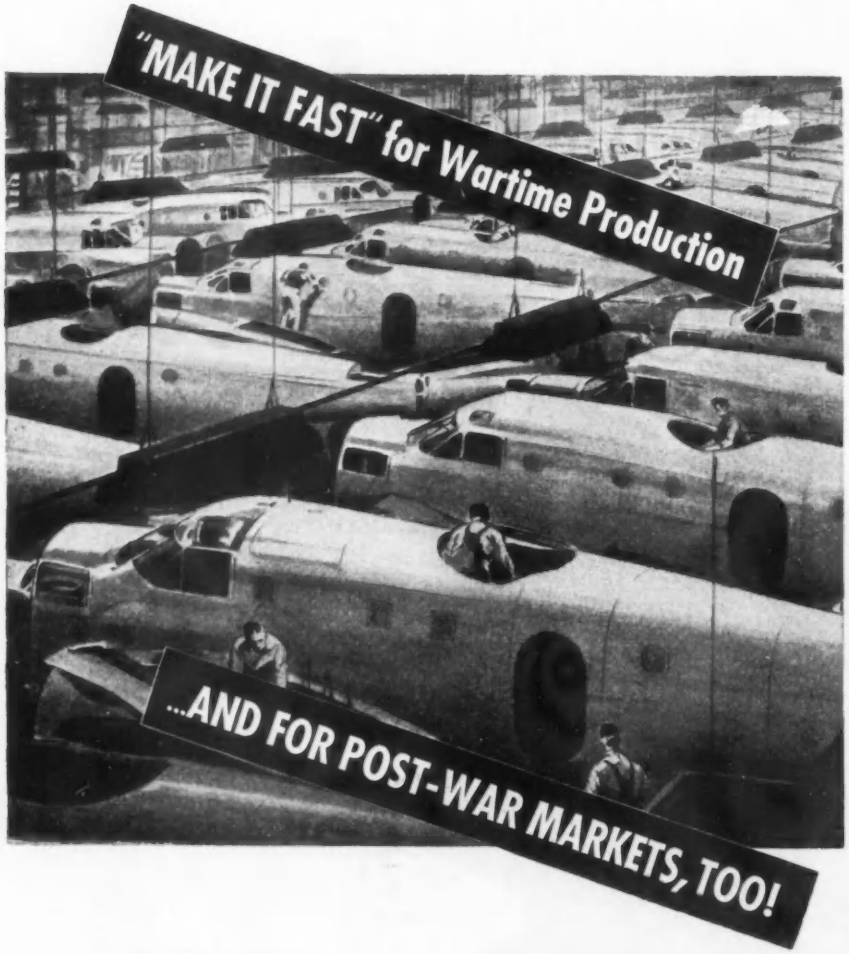
(6) Coolant pump and piping.

(7) Chip pan.

WRITE FOR PUBLICATION No. 482

THE LODGE & SHIPLEY MACHINE TOOL CO.
CINCINNATI, OHIO, U.S.A.

ENGINE TOOL ROOM AUTOMATIC OIL COUNTRY LATHES



★ Speed is the watchword for wartime production. For every minute saved on a part may mean lives saved—and a shorter war.

Production speed will be a vital factor in the post-war industrial world, also. Who will be *first* to win the post-war market? The plant that is geared to meet competition with low production costs!

Here at Acme our staff of consulting engineers can help you with your production problems, both today and after the war. You may need new dies, patterns, heat-treated aluminum castings. You may need special tools, which Acme can design and build. Recommendations of Acme engineers are available upon request.

Acme has helped many metal-working manufacturers to "make it *faster*." You incur no obligation in finding out what Acme can do for you.

FOR VICTORY BUY WAR BONDS AND STAMPS
ARMY NAVY

ACME

Pattern and Tool Company, Inc.

DAYTON, OHIO

HEAT-TREATED ALUMINUM CASTINGS — PATTERNS — TOOLS—TOOL DESIGNING—PRODUCTION PROCESSING

War Plant Expansions

Packard Motor Car Co. recently received an increase of $1,000,000 in its DPC contract at a plant in Toledo for additional facilities, bringing the total commitmenta to $7,500,000. Packard manufactures parts for the Rolls-Royce aircraft engine at this plant, which was built for the Liquid-Cooled Engine Division of Aviation Corp. Consolidated Vultee Aircraft Corp. has received a DPC contract boost of $300,000 for additional equipment at a plant in Los Angeles County, raising the total to $700,000.

Jack & Heintz, Inc., has had its DPC contract upped $2,000,000 for more machinery and equipment for a plant in Cleveland, bringing the total commitment to about $7,000,000. Federal-Mogul Corp. has been granted a $100,000 contract for machinery and equipment at a plant in Fresno, Cal., which will manufacture automotive and marine bearings. American Chain & Cable Co. has received a $60,000 award for equipment for a plant at York, Pa.

Capacity of the Formica Insulation Company, Cincinnati, manufacturers of laminated plastics, to use raw materials for fabrication will be increased between 20 and 25 per cent by installation of new treating equipment involving the infra-red principle of heating. High priorities have been granted for the manufacture and installation of the new treating equipment, which in cooperation with Cincinnati contractors is expected to be completed around March 15.

B-25C and D Bombers

(*Continued from page* 31)

Landing Gear

The fully retractable, hydraulically-operated tricycle landing gear, equipped with air-oil shock struts, is enclosed by doors in the up position. The main gear, with its 47 in. wheels, retracts into the engine nacelles, and the nose gear with 30 in. wheel into the fuselage. The tail skid is non-retractable. Emergency controls are installed so that in case of power failure the gear can be lowered manually.

A turn indicator visible to the pilot tells if the nose wheel is turned 15 deg in either direction while taxiing. A hydraulic shimmy damper, mounted on the nose wheel strut, prevents shimmying when taxiing or landing. When the yellow warning flags on the pilot's panel disappear, it shows that the gear is locked in the down position.

Brakes, hydraulically operated by means of toe-type pedals, also have air brake power at 550 to 600 psi for emergency.

Rx FOR HEART TROUBLE

on optical inspection equipment

The lens system is the *heart* of every optical inspection machine. Without perfection in this system—without special lenses, precision cells and housings—without optically flat mirrors, heart trouble results. This means distortion, fuzzy edges, and prismatic colors on the shadow image—inspection that is *fatal* to production.

Your protection against heart trouble is the **Jones & Lamson Optical Comparators.** For the lens system of each machine is literally prescription-designed by Jones & Lamson inspection engineers and built to those specifications by their own craftsmen. This highly specialized lens system, so necessary for inspection by optical projection, is your guarantee of trouble-free performance. The shadow image on every **Jones & Lamson Comparator** is dark, clear and sharp. It is absolutely accurate over the *entire* chart glass. The light around the image is entirely free from prismatic coloring.

For accurate, rapid, economical inspection . . .
BEYOND A SHADOW OF A DOUBT!

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Manufacturers of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies

PROFIT-PRODUCING MACHINE TOOLS

JONES & LAMSON
MACHINE COMPANY
OPTICAL COMPARATORS

Springfield, Vermont, U.S.A.

Flexibility of Operations at Aluminum Industries

(*Continued from page* 23)

rection. Then the seat is precision ground in a Cincinnati or Landis angular head collet grinder and the stem finish-ground in a Cincinnati Centerless.

A typical intake valve is made in about the same way except that it is of one-piece, using a bar of say 3150 alloy steel. Naturally, the one-piece construction eliminates some of the detail operations associated with the welding of the bimetal exhaust valve.

Since the machining of cast iron and aluminum pistons follows practically the same pattern, let us consider a typically aluminum piston. It may be noted that aluminum piston castings are produced in the permanent mold department of the new aluminum foundry. Before machining, the castings are normalized, if necessary. First machining operation is that of boring and facing of the open end, and centering of the head to provide the location for succeeding operations, this being done in small lathes. The wrist pin hole is drilled in a special horizontal drilling machine. The open end then is reamed in a lathe. The cross bore is bored and reamed in a horizontal machine and the bushing pressed-in on an arbor press.

Following these preliminary operations, the OD is rough- and finish-turned, ring grooves cut, the head faced and re-centered, in setups on Sundstrand lathes. The wrist pin hole is countersunk, the skirt snag ground, and oil holes drilled in bosses and ring grooves. The wrist pin boss then is precision-bored in a Heald Bore-Matic. The pistons return to the Sundstrand stub lathes for chamfering the open end, finish-turning the OD and ring lands. Final operation is that of cam-grinding the skirt in a Landis or Norton cam grinder.

Wrist pins are produced in large volume either for replacement or for matching with pistons. Due to the variety of pins in process and interferences with other parts in process, pins are produced in several ways depending upon open time in the screw machine department. The general run of pins is made from bar stock, although certain types are produced from tubing. In a typical case, the pins are produced on New Britain-Gridley automatics, drilling the center hole, turning the radius at each end, and cutting off. The ends are ground in a special end grinder, countersunk in a drill press. Next follows heat treatment. For this purpose, the pins are strung on rods to mask the center hole, the string being firmly connected by tightening nuts on the ends of the rods. The string is carburized, then the nuts are loosened, and the work is heat treated, quenched, and drawn.

For the final operations, the OD is roughed-ground in Cincinnati Centerless grinders, the ends buffed in the end grinders, then the OD finish-ground in centerless grinders. Since many of the pins require a mirror finish, the last operation is that of processing through a Cincinnati Centerless Lapper. It may be noted that a pin of this character is specified with roundness, straightness, and taper within 0.00015 in.

Machining of a water pump body is characteristic of the simplicity of handling that has been so skillfully developed by the management. First operation on the cast iron body is that of drilling flange holes, spot facing holes as well as the outer face of the hub, and burring the outer end of the hub, in one setting in a two-spindle Natco. Major operations of forming an angle, forming the hub, chamfering, facing the flange, boring and reaming, are performed in one setting in a new Gisholt turret lathe. Final operations are those of drilling, spotfacing, tapping, etc., in separate settings in single spindle drill presses.

Shifting the scene from the machine shops, let us take a brief look at the new foundry. Here is a completely modern aluminum and magnesium foundry operation housed in a new building

(*Turn to page* 62, *please*)

HIGHER AND HIGHER
GO STANDARDS!
The correct oil film to each individual bearing... automatically
GIDDINGS & LEWIS
Giddings & Lewis boring machine
BIJUR
AUTOMATICALLY Correct LUBRICATION
● Machine design marches on. Higher speeds! Greater precision! AND...SCIENTIFIC LUBRICATION! Hit-or-miss methods will no longer do. Production interruptions must be reduced to a minimum ... accuracy maintained ... investment protected. That is why industrial pacemakers specify BIJUR... The lubrication system that AUTOMATICALLY provides both a full, centralized control and a continuous oil-feed scientifically regulated for each bearing.
BIJUR LUBRICATING CORPORATION · LONG ISLAND CITY, NEW YORK
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Spicer Auxiliary Transmissions, Power Takeoffs and Universal Joints

. . . in one of the most powerful trucks ever built!

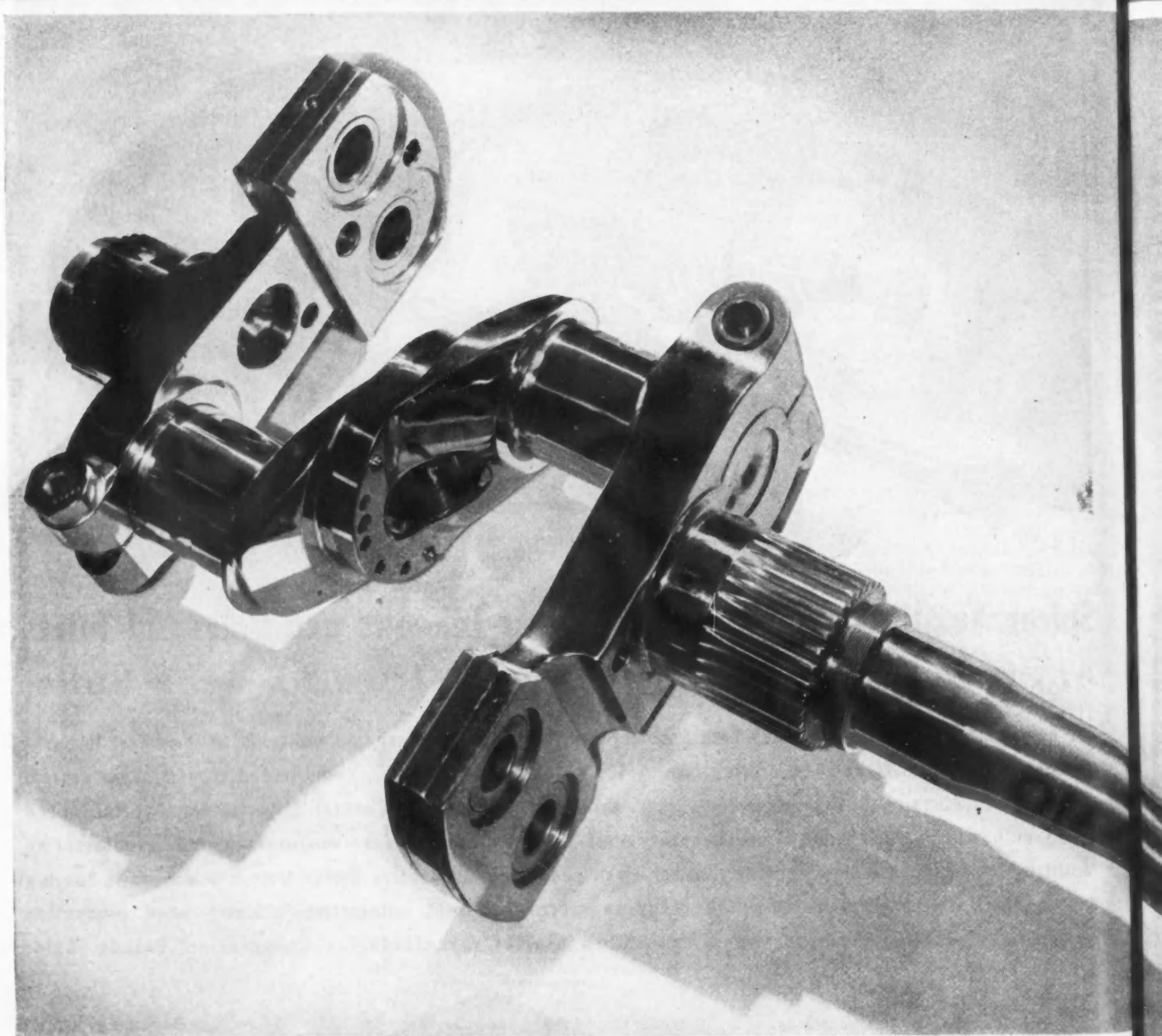
The new Pacific Car and Foundry M25 Tank Recovery Unit, consisting of truck and trailer, is an important factor in speeding war action right at the firing line. A 400 horsepower engine . . . complicated transmission system driving axles carrying 900-pound wheels . . . . ability to transport a General Sherman tank at top speed of 30 m. p. h. . . . . these are Tank Recovery Unit features which Spicer engineering and manufacturing facilities have helped make available. In war or in peace, no automotive power transmission job is too big or too small for Spicer. We shall be ready to serve the great automotive industry when production for enormous civilian demands swings into action. Spicer Manufacturing Corporation, Toledo, Ohio.

41 YEARS OF Spicer SERVICE

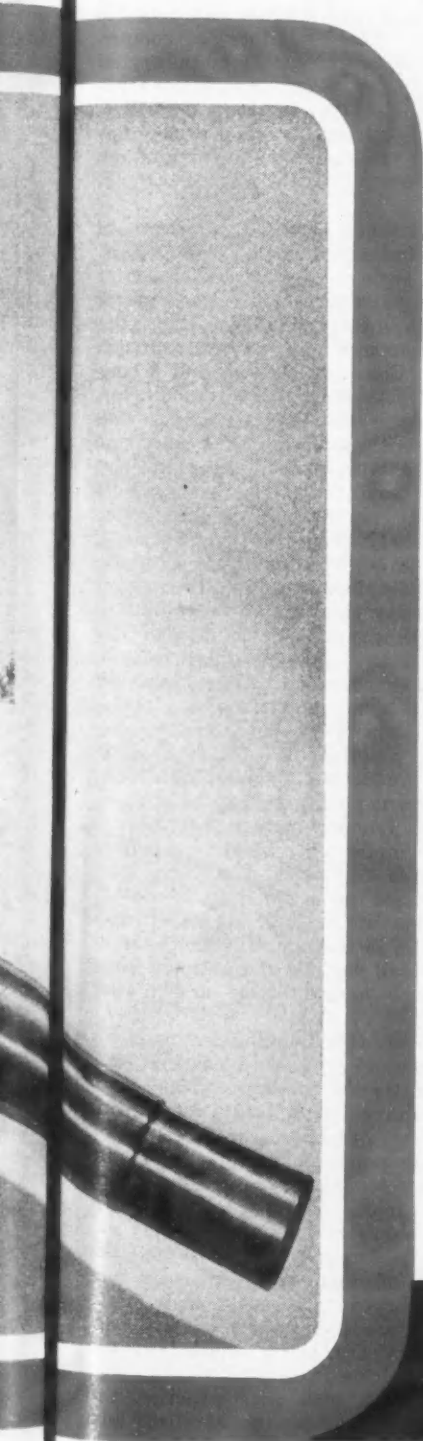
BROWN-LIPE CLUTCHES AND TRANSMISSIONS • SALISBURY FRONT AND REAR AXLES

SPICER UNIVERSAL JOINTS • PARISH FRAMES, STAMPINGS

A $25 PIECE OF STEEL



THAT'S WORTH $750



When shipped to the forger, the electric furnace steel for this aircraft engine crankshaft costs about $25.

But as you see it here in the finished form, it's worth some $750.

What a difference in values! $725—representing the cost of more than 600 operations necessary to complete this vitally important part of a fighting airplane's power plant.

Suppose a small imperfection in the steel should show up to mar a bearing surface just as the crankshaft approached final inspection. Rejection would mean hundreds of dollars and many man-hours lost—to say nothing of unbalanced output schedules.

That's an important reason for the use of Republic Electric Furnace Steels for such applications. They are as clean and sound as the most expert furnace practice can make them. *They are insurance against such losses.*

Of course, this crankshaft must deliver unfailing performance. Republic Electric Furnace Steels are "targeted" in the electric furnace to hit the most rigid specifications* on the nose—time after time.

Also, this crankshaft must move through production without upsetting manufacturing schedules. Because of their consistent uniformity and homogeneity, Republic Electric Furnace Steels do not introduce variables requiring alteration of established fabricating practices.

With its rich experience in the production and fabrication of electric furnace steels, unequalled by any other producer, Republic is qualified and ready to assist you in profitable application of these steels.

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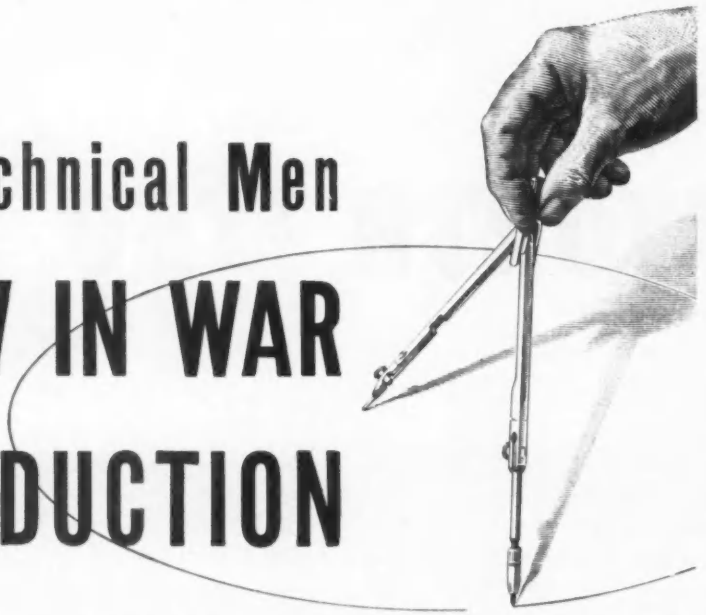
**Republic Electric Furnace Steels provide highest values in hardness, toughness and strength to weight ratio—resistance to severe tensional, torsional and compressional strains, to shock and impact, fatigue, elevated and sub-zero temperature, corrosion, oxidation, abrasion and process contamination.*

REPUBLIC
—Leader in the Production of
ELECTRIC FURNACE STEELS
"quality" steels . . . alloy . . . stainless

To Technical Men NOW IN WAR PRODUCTION



Business and Industry operate on the *same* fundamental principles in war-time AND in peace-time!

Realization of that vitally important fact is enabling thousands of serious-minded men to prepare now for better positions in the post-war world while strengthening their present ones.

The Alexander Hamilton Institute's executive training plan provides a thorough groundwork in the basic principles which all executives must know; it applies to all types of business and industrial organizations.

The Institute's Course and Service is especially valuable to technical men—specialists—who need training in the fundamentals of business. Before these men can assume wide executive responsibility, they must have a working knowledge of Marketing, Accounting and Finance as well as Production.

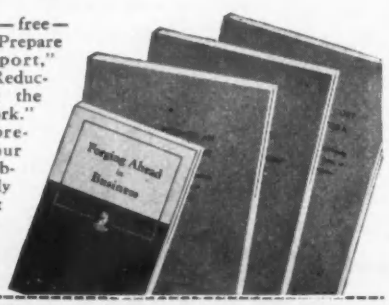
Institute training has been taken advantage of by more than 134,000 production men! They know that among today's students are tomorrow's leaders.

The Alexander Hamilton Institute has the endorsement of leading industrialists and business men. And it is largely because these high-ranking executives recognize the value of the Course and give their cooperation that such a plan is possible. Among those who contribute to the Course and Service are: Alfred P. Sloan, Jr., Chairman, General Motors Corporation; Clifton Slusser, Vice President, Goodyear Tire & Rubber Co.; Frederick W. Pickard, Vice President and Director, E. I. du Pont de Nemours & Co. and Thomas J. Watson, President, International Business Machines Corp.

FREE HELP FOR YOUR PARTICULAR NEED

FORGING AHEAD IN BUSINESS, the Institute's 64-page descriptive booklet, contains a message of distinct importance to production men. Today's timely edition can be of immense value to men who are genuinely interested in self-improvement. There are no copies for the merely curious, but to any man of serious purpose, it is sent free and without obligation.

In addition, while the supply lasts, we will also send—free—a copy of "How to Prepare an Engineering Report," "Methods for Waste Reduction" or "Controlling the Cost of Maintenance Work." These reports were prepared especially for our technically-trained subscribers. Please check only ONE of the reports, and it will be sent to you along with a copy of "Forging Ahead in Business."



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Please mail me a copy of "Forging Ahead in Business" together with a copy of the book checked below—both without cost.

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Business Address.....

Position.....

Home Address.....

(*Continued from page* 58)

constructed along the latest lines. It features a complete system of materials handling, including cranes, hoists, conveyors, and industrial trucks. Excellent illumination is afforded by a system of fluorescent light sources.

The Aluminum Industries foundry operation stems from a basic philosophy that perfection can be achieved only through sound engineering and continued research. Any new project begins with the engineering of the casting, this service being offered to the customer on the principle that best results are achieved only when functional design takes into account the characteristics and foibles of a non-ferrous foundry practice. From the research end, the foundry offers a comprehensive chemical and metallurgical laboratory, supplemented with X-ray equipment and one of the new spectrographs. Such equipment is widely employed in fundamental investigations, in development work, and in trouble shooting.

To further assure perfection of quality and economy through low rejections, each casting is produced from precision patterns which stem from the initial engineering study. Even this is not enough to assure constant quality. Consequently, we find a comprehensive system of precision gaging, employing a variety of rugged steel fixtures with gaging blocks and supplemented with special templates for checking contours. Thus it may be seen that engineering which begins with a study of the part to be made, extends through fundamental research, pattern development, quality control, and foundry practice at every turn.

The foundry proper is divided into two sections—one for aluminum, the other for magnesium. The aluminum operation is more or less of a glorified jobbing shop what with the requirement of handling 26 different alloys and the production of something around 600 different parts. It may be appreciated that foundry management here is quite complicated when contrasted with those foundries that have been concentrated upon one part alone—as in the case of airplane engine cylinder heads—or in foundries which handle only a small variety of relatively large parts such as crankcase and blower sections.

Moreover, this foundry combines the production of both sand castings and permanent mold castings. The aluminum foundry has a large department devoted to permanent mold castings, producing small connecting rods, pistons, injector type carburetor bodies and a variety of other parts. This technique has not yet been widely extended in magnesium due to the vagaries of this important new material. However, several small parts are being produced in permanent molds, and others are being studied at the present writing.

In keeping with good practice, the foundry has been departmentalized into

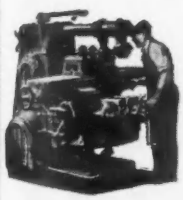
What will your future **I.P.** *be?*

††

This is the Second of a series of advertisements presenting "Industrial Par" and its importance to your company in all future planning. Save this and succeeding I.P. advertisements as the basis for discussion and as a guide to your planning program.

So much from so little

The Annual National Investment* in machine tools represents only 2% of the total value of products produced by machine-tool-using industries.



YES — in the ten peace years 1927 to 1937 — the builders of machine tools produced a yearly average of 122 million dollars worth of equipment for American industry. The industries that bought and used these machine tools were able to produce an average of about 9 billion dollars worth of peacetime products annually in those same years. The annual investment in machine tools represented only about 2% of the total value of products created by these machine-tool-using industries — the makers of engines and turbines, agricultural and construction machinery, automobiles, planes, locomotives, household appliances and many other useful things.

In terms of productive power this is impressive — certainly "very much from very little." But what significance have these rather startling ratio "figures" to industrial management? Industrial statistics show that the national output per man-hour tends to increase constantly — its previous rate of 2½% per year compounded can be expected to advance to 4% or 50% increased output per man-hour every 10 years.

Manufacturers who intend to keep step with a high level of national prosperity — the volume production which means more goods for more people at lowest cost and security of jobs and wages for the greatest number of workers — must strive to attain the 50% increased output pace. Certainly full advantage must be taken of the inherent ability of machine tools to achieve the most with available man-hours, for only with the most modern machine tools can any manufacturer hope to compete successfully over a period of years as well as make workers' jobs safer, easier, and more productive.

Isn't it only logical to equip your plant with machine tools — those possessing the greatest sustained productive power, the ability to produce fast, accurately at lowest cost — the better to win your race with competitors in the world of peace production to come?

Back the attack **BUY MORE BONDS**

Spotlight facts for your future I.P. *planning*

- *Production methods — developed in wartime —increase man-hour output; pent-up buying power — released in peacetime — demands increased production.
- *The rate of 2½% increase per year output per man-hour, established by a 12 year record of industrial production, can be expected to reach at least 4% per year — compounded.
- *Manufacturers must set a goal of 50% increased output per man-hour every 10 years — to maintain a high level of national prosperity and achieve its benefits in terms of security of jobs and wages for the greatest number of workers and the volume production of more goods for more people at lowest cost.
- *Machine tools — the most modern, most efficient — are recognized as the most effective implements of mass production and increased output at lowest cost — but only continual replacements with the newest and finest machine tools assures full productive capacity. *Such replacements yearly should be equal to 10% of the total machine tool investment — in keeping with increased output.*
- *The cost of machine tools is insignificant in terms of their productive power . . . from 1927 to 1937, according to census reports, American manufacturers had only a total of about 2% invested yearly in machine tools in ratio to a total volume of 9 billion dollars' worth of production annually.

†† **Industrial Par** — *the constantly increasing output per man-hour equal to approximately 50% every 10 years.*

KEARNEY & TRECKER CORPORATION

MILWAUKEE 14 WISCONSIN

Milwaukee Machine Tools

specific functions. Thus we find separate areas devoted to the melting of aluminum and magnesium; permanent mold departments in each section; core departments; molding departments; cleaning rooms; etc. The molding floors are equipped with the most modern molding machines, including squeezer type machines, jolt-and-squeeze-rollover machines, and special machines adapted here. Cores are made by machine and by hand, depending upon the character of the job.

Aluminum is melted from alloy metal pigs, supplied by outside vendors, and is handled in a battery of hearth type reverberatory furnaces in several ranges of melting capacity. All scrap resulting from this operation is remelted into pigs for re-use.

Supplementing these facilities are a battery of ten 2000-lb oil-fired rotary melting furnaces for aluminum. Molten aluminum for the sand foundry is taken from a battery of sixteen 450-lb, tilting type melting pots and distributed by ladles to the pouring stations. The aluminum melting department has a complete network of American Monorail conveyors for handling ladles and other heavy lifting and transportation tasks. In the rear of the department is a corrugated asbestos curtain which aids in confining fumes and smoke.

Magnesium is melted in the usual open pots. Those familiar with magnesium foundry practice will be impressed with the painstaking care that is taken to eliminate fire hazard and to assure the proper control of fluxing medium which must be used as extensively both in melting and in pouring. Special precautions are taken to prevent the entry of flux into molds by baffling, by filtering, and by the use of self-skimming ladles so arranged that the metal flows from the center of the ladle through an external spout.

Ample facilities are afforded for the sand blasting of castings in Pangborn units and for the snagging, burring, and grinding of magnesium castings, in special booths built by Peters-Dalton, Inc. The fine metal particles resulting from this process are washed away by a stream of water to prevent fire.

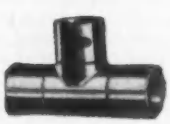
The aluminum permanent mold department occupies a long bay in the foundry. Here will be found rows of molding stations with holding pots arranged so that one pot serves three molding stations. This area is made comfortable by a special air cooling system in which cooled air is forced to an underground tunnel by fans mounted in the monitor. The cool air is then expelled from openings in the floor at each molding station.

Another major department in the foundry is heat treat. Here will be found furnaces for solution treatment of aluminum castings, for aging, and for annealing. In some instances, the equipment is employed for a combination of aging and solution treatment. One of the latest items of equipment in this department is a huge General Electric annealing furnace of elevator type, combined with a quenching tank.

Among the equipment noted above is a battery of two Despatch pot-type solution, heat treating and annealing furnaces which can be sealed for treating either aluminum or magnesium sand and permanent mold castings. One of the larger pieces of equipment is a gas-fired Despatch aluminum heat treating furnaces combined with a quenching station. This unit is 15 feet long, 7 feet wide and 7 feet high.

The aluminum and core department occupies another of the major areas in the foundry, containing rows of molding machines and hand molding stations. The central section of this department contains the sand core racks for handling and distributing the cores. An important feature of the operation is a comprehensive sand conditioning and distribution system installed by Jeffrey. This, in turn, is supplemented by an underground Jeffrey shake-out sand conveyor system with hoppers and conveyor belts located in a tunnel.

In addition to the other quality control methods used here, castings are checked for Brinell hardness. The inspection department also boasts a Magnaflux Xyglo inspection machine for detecting surface imperfections. However, this is used only when specified by the customer.



YES, NIBCO WROT Fittings are now made from aluminum as well as copper. They are speeding up airplane production because of their absolute uniformity. Every piece is perfectly formed . . . uniform in thickness and strength. They're used in many famous battle planes, including the Boeing Flying Fortress. The same qualities which recommend NIBCO Fittings for that very trying service prove that they will be ideal for *your* Post-war products. We'll be glad to discuss your plans for future needs at any time.

NORTHERN INDIANA BRASS CO.

ELKHART, INDIANA

VALVES AND FITTINGS SINCE 1904

Raiding Party BY JAMES M. SESSIONS

NO. 2 OF A SERIES "HIGHLIGHTS OF WORLD WAR II" PRESENTED BY TUBE TURNS (INC.) LOUISVILLE, KY SEE OTHER SIDE

Forging INGENUITY

Tube Turns is proud to be one of the originators of many wartime advancements in upset and mechanical press forging designs, practices and heat treatments . . . in both steel and aluminum. This same ingenuity and practical experience is available to you now on war products—and after victory for many industrial needs. *Tube Turns (Inc.), Louisville, Ky.*

TUBE TURNS

Forgings for Industry

"Raiding Party." The dramatic Sessions painting on the reverse side shows a U. S. Navy task force's swift approach to a Jap base. In it Sessions captures the tension that precedes the raiding party's destructive arrival.

New Products

(*Continued from page* 42)

coming originally from Imperial Chemical Industries, Ltd. Polythene is the generic name for the tough plastic manufactured by the polymerization of ethylene.

In announcing that polythene is now being manufactured in commercial quantities, the du Pont Company emphasizes that the material is available in substantial quantities only by specific allocation for war purposes.

Supplies of polythene heretofore available have gone into production of items urgently needed by the armed services, where this new plastic has adequately demonstrated its advantages as a covering for electric wiring and cable.

Properties upon which it is expected that many uses will be based include flexibility and toughness over a wide range of temperatures, unusually good resistance to water and to penetration by moisture, chemical inertness and excellent electrical properties.

Polythene occupies a peculiar place among plastics. In thin sections, it may be classified as non-rigid, yet it does not have the limp rubbery quality that characterizes most non-rigid plastics. However, thick specimens exhibit sufficient stiffness to warrant classification of the material among the more rigid plastics.

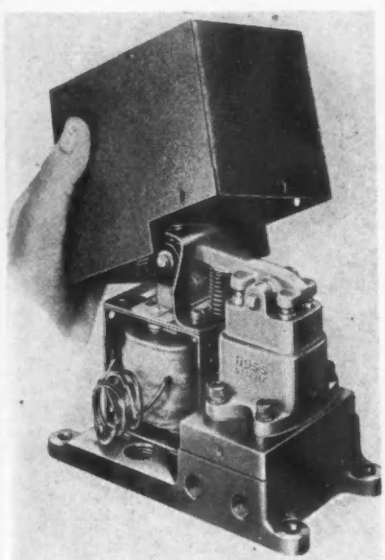
The new plastic is readily molded and fabricated by present methods with existing molding and shaping equipment. It can be extruded, injection molded, compression molded and calendered. In sheet, rod or tube form it can be machined, cut, blown, blanked or swagged.

Midget Air Control Valve

A compact solenoid air control valve which can be operated at sustained speeds up to as high as 400 reversals per minute is a late development of the Ross Operating Valve Co., Detroit, Mich.

This newly designed valve, known as Ross Model No. 835, is a ¼-in. heavy-duty, solenoid-operated, 4-way valve for the control of double-acting cylinders; it may also be used as a 3-way valve by plugging one outlet.

Overall dimensions of this Model No. 835 are length 7 in., width 3½ in., height 5¼ in. Other features are its low current consumption, noiseless operation and long life.



Ross No. 835 solenoid operated valve

Portable Dynamic Balancing Equipment

The Vibrascope Co., New York, N. Y., announces that the Davey portable balancing equipment for dynamic balancing of machine parts of all sizes in their own bearings or in bearings built for the purpose, is now supplied with an added feature. The equipment consists of a Vibrometer which mea-

To Help You
AND YOUR
ENGINEERING STAFF

RIGHT NOW many concerns are making production plans for post-war markets for improved and entirely new products. For these Littelfuse has a definite service—without obligation.

SEND FOR THIS
LITTELFUSE AID

Littelfuse has engineered many outstanding developments. With wartime experience and two Littelfuse plants this service now has a much wider range than heretofore.

Fuses and Mountings for aircraft, instruments, television, radio; **Fuse Clips**, Beryllium Copper silver-plated, and Phosphor Bronze; **Terminals; Surge Protectors; Mercury Switches;** Indicators, neon and mechanical; **Signalette** radium-active fluorescent indicator; **Fine Wire Products; Thermocouples; Circuit Breakers;** etc.

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Without obligation send material for Post War Planning to:

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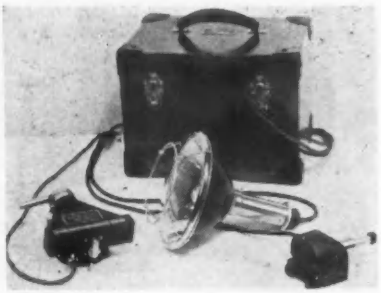


Davey portable balancing equipment

sures vibration amplitude directly and a stroboscope which gives a direct visual reading of "high spot" or phase angle. The new feature is a remote control switch mounted on the Vibrometer which places the entire operation in the hands of a single operator, instead of adjustments being made by a second operator, as in earlier models. Two models are available weighing, respectively, 22 and 25 lb complete in portable case with batteries.

New Products for Aircraft

(*Continued from page* 39)

With the Pony Express Field Service Unit, the desired voltage for airplane equipment can be maintained even when using a high rate of discharge such as is necessary for starting engines, testing gun turrets, etc. Radio equipment will not burn out because of exessive surges of voltage. The voltage stays up to the level desired.

This unit can also be used as a portable power plant for lighting and as a source of power for soldering irons and other electrical equipment where 24 volts direct current is needed.

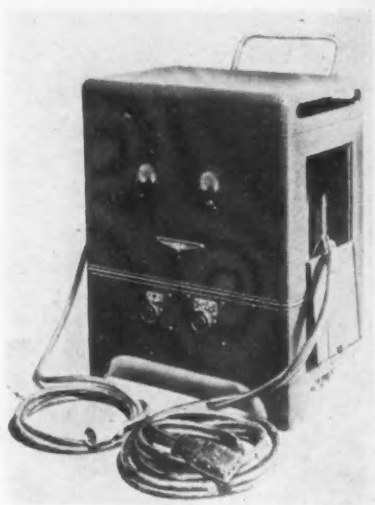
Heavy Duty Rectifier

A rectifier, heavy enough to operate modern, heavy-duty aircraft gun turrets has been developed by Airplane Manufacturing and Supply Corporation, North Hollywood, Cal. The extra heavy inrush current required can be delivered while ample voltage is maintained to prevent drop-out of turret relays. The "no-load" voltage is within the safe limit of any delicate electronic device or other electrical equipment in a plane.

The Amsco rectifier provides all power needs for the ground crew in servicing and testing planes of all sizes. It provides voltage control with a "no-load" limit that may be set and locked to prevent tampering.

The rectifying element is of the "self-healing" dry disk magnesium-copper sulphide type. No bulbs or tubes are required. The bridge circuit is entirely insulated from the primary. Three phase rectification guarantees smooth d-c output. This output can be quickly regulated by a tap switch.

Thermal protection is provided against overload or overheating. A small fan motor guarantees air circulation.



Rectifier made by Airplane Manufacturing and Supply Corp.

Felt
STANDS GUARD
BETWEEN IMPACT AND INSTRUMENT

Felt protects delicate instruments of control and observation from the many shocks to which a modern, wartime plane is subjected.

That's because felt, as engineered by Western, has *special* properties which provide a *yielding* support for units that *must not be rigidly supported.*

Ranging from wool softness to rock hardness, Western Felt neither frays, ravels or loses its shape. Among other properties are: resiliency, flexibility, compressibility, and resistance to water, age, heat and oil. Felt is being widely used as gaskets, pads, cushioning gaskets, washers, weatherstripping, and sound and thermal insulation.

Western engineers are prepared to give you expert advice, without obligation, on the possibilities felt offers for your product. Write us today.

WESTERN FELT WORKS
4035-4117 Ogden Avenue • Chicago 23, Illinois
Branch Offices in All Principal Cities

WESTERN Felt
Largest Independent Manufacturers and Cutters of Wool, Hair and Jute Felts

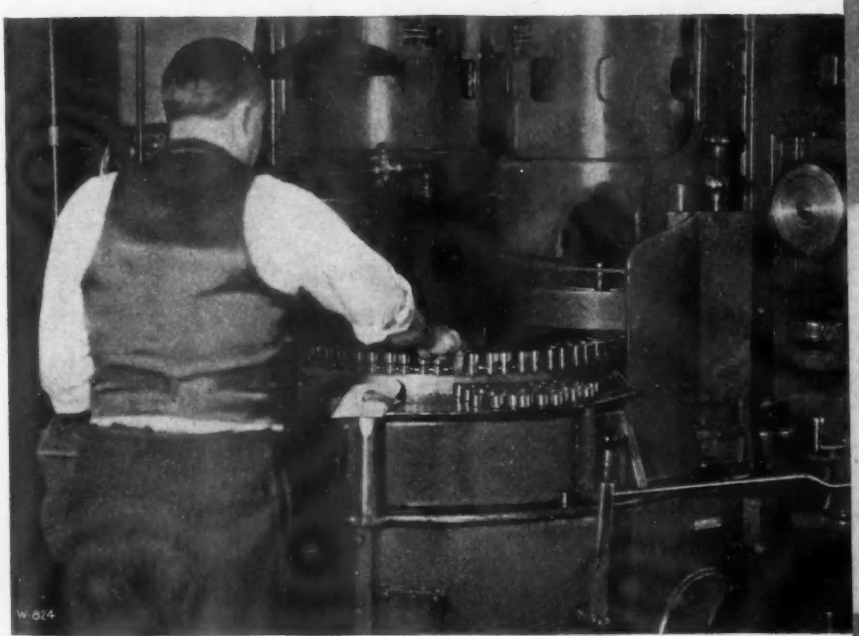
"PUT IT ON THE BLANCHARD"

These heat treated steel trunnion bearings are ground on a No. 16-A2 Blanchard Surface Grinder.

They are loaded on special 80-station fixture with magnetic studs locating from previously ground surface. The end of the bearing is then ground to very close limits. At the unloading station the work is automatically ejected and demagnetized.

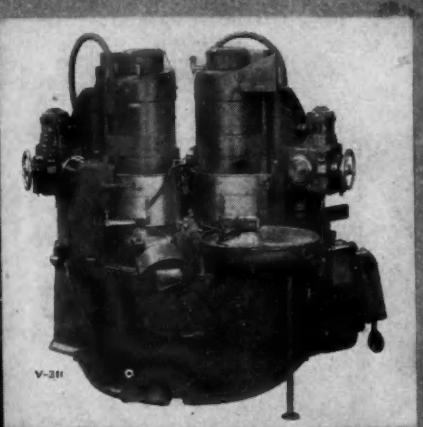
.005" to .015" of stock is removed, to limits of ± .0005". 18,500 pieces are produced per 8 hour shift.

Grinding Trunnion Bearings on No. 16-A2 Blanchard Surface Grinder.



CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- ★ Production
- Adaptability
- Fixture Saving
- Operation Saving
- Material Saving
- ★ Fine Finish
- ★ Flatness
- ★ Close Limits



★ . . . . . *Especially valuable on jobs like the one illustrated.*

BLANCHARD

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS.

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

New Low in Thermal Conductivity

PROVIDED BY

CHACE

Manganese

ALLOY

No 772

This alloy has a thermal conductivity less than 50% that of stainless steel . . . less than 10% that of yellow brass . . . and only 2% that of copper. Chace Manganese Alloy No. 772 offers some very decided advantages to manufacturers seeking an alloy of low thermal conductivity.

This alloy also possesses:

High Electrical Resistivity
(1050 ohms per circular mil foot)

High Temperature Coefficient of Expansion
(Twice as great as that of ordinary steel)

High Vibration Damping Constant
(40 times higher than for steel)

Chace Manganese Alloy No. 772 now available in:

SHEETS *from .003" up in thickness and from .0625" to 6" wide.*

RODS *down to .125" diameter.*

WIRE *down to 16 gauge (.050").*

Complete engineering and research facilities available . . . "Bulletin No. A-942" giving detailed information regarding "Chace Manganese Alloy No. 772" is yours for the asking.

W. M. CHACE CO.
Manufacturers of
Thermostatic Bimetals and Special Alloys
1610 BEARD AVE • DETROIT 9, MICH.

Goodyear Aircraft's Rapid Growth

(*Continued from page* 35)

dimensions, so thus the preforming eliminates trimming the edges after stretching. Self-aligning stretcher jaws pull while the hydraulic ram is raised, providing both a horizontal and a vertical stretch. This method is a considerable time saver over the old method of using plaster models in forming such parts.

Goodyear engineers also developed an explosive rivet gun which detonates explosive rivets by passing a low voltage high current through two copper leads joined by a stainless steel tip with a restricted area. A small step-down transformer provides the proper current. When the current passes through the high resistance stainless steel, the restricted area becomes red hot within a few seconds. This heat detonates the rivet by conduction. The gun is adaptable for use with any size rivet as the copper leads and tip are readily removable. The gun is light, portable and easy to handle, the riveter simply holding the rivet in place with the gun and operating it by squeezing the trigger.

After receipt of the Corsair letter of intent, a nine-man team was set up to direct the planning of this operation under the direction of a temporary coordinator, Russell DeYoung, who had pre-war engineering and production experience in Goodyear plants in Akron and Java. It was the objective of this small nucleus organization to acquire and train personnel, requisition new and finished material, collect basic and detailed information for the engineering, tooling, over-all planning and procurement on the Corsair contract and to estimate and order the material requirements.

George Sherry, an engineer with 25 years' service, took over direction of the aircraft tooling job. His previous company experience included such diverse activities as managing a 30,000-acre cotton plantation in Arizona, airships and retail merchandising. He was assisted by tooling engineers from the automotive, aircraft and steel industries, a former plant layout engineer and another man who acquired his early experience in Denmark. Sherry built up an organization of 3000 men, assisted by outside engineering companies. A questionnaire was mailed to every machine shop within 250 miles of Akron to select those qualified for work to be done.

Recruiting supervisory talent for production jobs was a matter of scanning Goodyear Tire's extensive personnel and bringing in those men who would fit into the aircraft organization through experience or whose duties had been curtailed by the war and thus were available for training in this new work. Seasoned men were selected from the parent company for important managerial positions. H. I. Balknap,

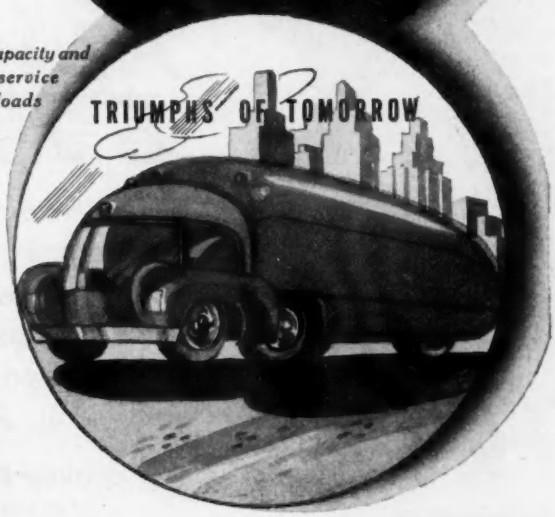
Gabriel

Model F

HEAVY DUTY HYDRAULIC SHOCK ABSORBER

Now serving with distinction on many fighting fronts.

Increasing capacity and improving service where big loads are carried.



Big . . a mighty means of prolonging the life and extending the service of the huge new six-wheel armored fighting cars now used by Uncle Sam—the Gabriel Model F, Heavy Duty Hydraulic Shock Absorber is now available for the same vital duty on heavy duty trucks, buses and other large-size motorized transportation units.

Gabriel's wartime service, in addition to hydraulic controls for airplanes, jeeps, armored cars and trucks, includes 60 mm. trench mortar shells and fin assemblies and other precision machine work.

THE GABRIEL COMPANY ★ Cleveland 14, Ohio

placed in charge of Plant C, had been plant superintendent in Java. A. C. Michaels, chief of the Corsair production, had been superintendent of the Gadsden, Ala., plant. Zeno Wicks, who directs airframe production on the Consolidated, Curtiss-Wright and Grumman orders, as well as airship construction, had operated the Navy's first helium plant at Amarillo, Texas, and later was superintendent in charge of the construction of the Akron and Macon at Goodyear.

The former superintendent of Goodyear's Swedish plant and the chief engineer and production superintendent from Brazil also joined the Aircraft organization. An engineering graduate assigned to straighten out the company's restaurants was transferred to become an aircraft general foreman. A truck tire foreman at Akron, a night superintendent at Gadsden, a division superintendent in Australia all were drawn into the burgeoning aircraft organization for supervisory posts. The largest single group of general foremen came from the engineering squadron, although the sales and export departments also furnished a considerable number for supervision and staff jobs.

Making this heterogeneous organization click was a matter of team spirit, with Blythe as the quarterback. Blythe is a believer in the conference method because he thinks there is no substitute for a personal get-together to solve critical problems. Therefore, frequent parleys were held among supervisory personnel to straighten out problems of materials, priorities, labor and engineering that were hampering production. Such conferences also serve as a check upon individual performance. Periodic meetings of the executive council, management control committee, operating committee, factory council, budget control committee, production delay committee and engineering council are a routine function at Goodyear Aircraft.

A vast number of new workers had to be trained for the rapidly expanding Goodyear Aircraft Corp. In 1942 alone the employment leaped from 3000 at the beginning of the year to 31,000 at the close. Many of the early employees were men from 18 to 25 anxious to get into the aircraft business. Therefore, the draft took a particularly heavy toll among this class of workers, costing Goodyear many prospective foremen and supervisors. After Pearl Harbor and the cutting off of the far eastern rubber supply, it was expected that Goodyear's tire building activity and other rubber fabricating work would be greatly curtailed, so it was anticipated that 10,000 to 15,000 employes would be transferred from such jobs to Goodyear Aircraft. Instead, however, the war stimulated production in these plants on military tires, barrage balloons, rubber boats, gas masks and similar war items, so not only was Goodyear Aircraft deprived of this potential labor supply but the rubber fabricating factories also went into the labor market to hire 15,000 additional workers who had been prospective aircraft employes.

With the draft and other war plants cutting into the Akron labor supply, Goodyear Aircraft decided to tap the largest remaining reservoir of labor, womanpower. There was only one woman factory employe on Jan. 1, 1942. The number had increased to 500 by June and then more than 11,000 were hired in the next six months to bring the total to 12,000 by January, 1943. Three women were hired to every man in the last half of 1942. Forty-seven per cent of present employes are women and 52 per cent of the women workers are on production jobs. The Martin wing job in Plant C uses 73 per cent women employes.

Originally it had been estimated that only 15 per cent of the jobs could be filled by women. Now this has been revised upwards to 60 per cent of the jobs for which women are qualified. Labor-saving devices such as lifts and hoists to eliminate heavy work have made this big upward revision possible.

Girls even now are being trained as junior engineers in intensive training courses now under way at the Universities of Cincinnati and Akron. Thirty girls are enrolled at each institution in a cooperative course during which they

FLYING STEEL
From Atlas in the Army and Navy's greatest bombers softens up the tough spots in Axis resistance and makes the way easier for Allied armies all over the world.
ATLAS DROP FORGE COMPANY
LANSING, MICHIGAN
ATLAS
DROP FORGINGS

THE NOISE OF MARCHING FEET IS RINGING IN OUR EARS

It's true—right now we haven't a product nor an hours production time for sale. Every minute of the day is taken up in producing for Uncle Sam.

So why advertise? Here's why. Some day our contracts are going to be terminated. Victory will be ours. And, we'll celebrate deliriously. There'll be a rumble of marching feet down every Main Street in America. And we want to be ready for that noise. We have an obligation to rehire our returning men — and we'll need orders for peace time products to keep those men at work.

Someone representing Bellevue Mfg. Co. is going to be waiting in your office to ask the privilege of "figuring on your needs". To tell you about our up-to-the-minute facilities — about our tool and die making departments, our deep draw presses, our plating and painting and our assembling methods. And they're going to tell you about an organization of loyal employees, who can be depended upon to produce craftsmanship work by the million pieces.

Thru these advertisements we hope you'll remember Bellevue as a preferred source for deep drawn and *precision* stampings.

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Precision Made Stampings

BELLEVUE, OHIO

work alternately six weeks in the shop and six weeks in the classroom. Engineering mathematics and mechanical drawing are stressed. Girls with at least one year of college or with outstanding mathematical ability in high school have been selected. They are paid $50 monthly and all expenses while learning.

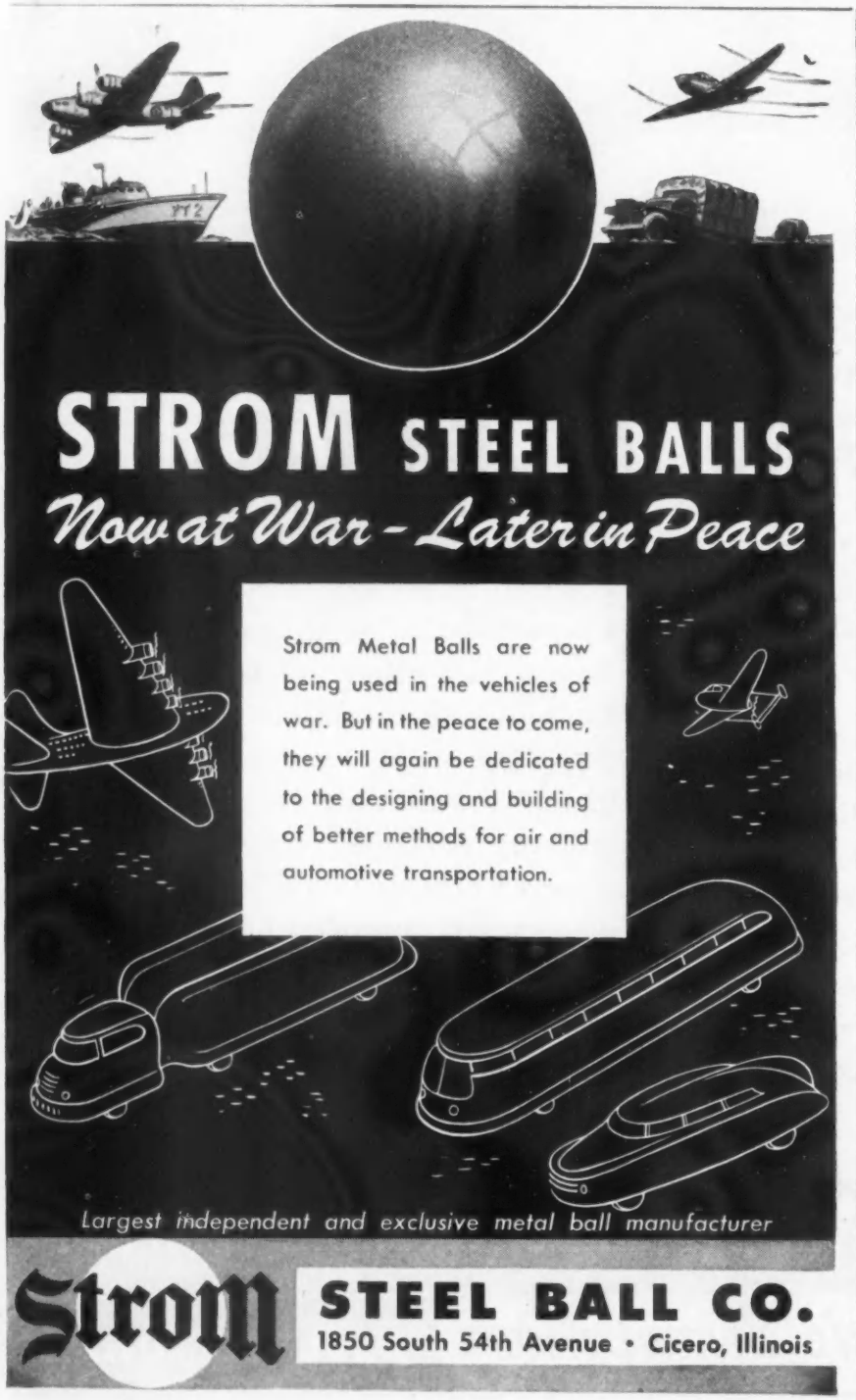
Due to the draft and other reasons, there was a large labor turnover and Goodyear Aircraft was confronted with a major problem in obtaining new workers, especially as all four plants were expanding at the same time. In addition, the plants were located on the outskirts of Akron, four miles outside the normal industrial area, causing inconvenience and transportation difficulties for prospective workers, since all workers must depend upon motor transportation in traveling to and from work at the plants, about 82 per cent of them using private automobiles on share-the-ride basis and the other 12 per cent the bus service. Employes were urged to bring in their relatives and many did so, especially in-migrants from the South. When the labor shortage became acute, the personnel department launched an intensive campaign to bring in new workers. Many small Ohio towns in the vicinity of Akron were combed for mechanics and other prospective aircraft employes. A quota system was organized for the personnel recruiting staff on the order of a sales competition and Goodyear labor recruiters, some of them former salesmen, were exhorted to go over their quotas. These men visited many small towns in Kentucky, West Virginia, Tennessee, Georgia, Florida and Alabama, states in which there was not a great deal of war production and an untapped labor supply. The Goodyear men went to union halls and advertised in small town and rural newspapers in their quest for aircraft employes.

Then when the new workers did come to Akron, they were confronted with a housing shortage. Goodyear Aircraft representatives personally solicited Akron home owners in an effort to have them rent rooms to war workers. A listing of available rooms was kept at the plant for new employes. The company aided in-migrant workers with families to locate living quarters, helping them meet the down payments on homes in new defense housing developments.

This influx of workers from the South presented some new problems. Aircraft practice had been to use light jigs of two-inch tubing on airplane manufacturing work. The skilled workmen in the West Coast aircraft industry and elsewhere were accustomed to these light jigs and handled them with care. But many of the raw-boned new employes from the South never had been in a factory before and they were clumsy and careless at the start. Angle iron jigs were much too frail for their handling, so Goodyear built sturdy jigs of eight and 10-inch tubing to withstand any rough treatment. Tools and jigs had to be made foolproof in order to maintain safety and quality. Drill presses were equipped with bushings to guide new operators in the right places.

Goodyear Aircraft had to undertake a tremendous training program to assimilate and prepare these incoming workers for their new jobs. Although current employment is somewhat over 29,000, the company has had to hire more than 100,000 workers to date, including rehires. The training of aircraft workers has been greatly simplified. It now takes about five or six weeks on the average to train a new worker for the simpler jobs. Learning riveting and assembly may consume two to three more weeks. At one time Goodyear had 31 different training schools in operation, 23 for production workers and eight for specialized skills. School courses of three to six weeks' duration are conducted in spot welding, riveting, sheet metal work and hand forming. Well illustrated instruction manuals written in simple style are provided for almost every job. New employes are given an induction course in factory methods, routine and safety. It has generally been possible to eliminate many unfit or undesirable em-

(*Turn to page* 152, *please*)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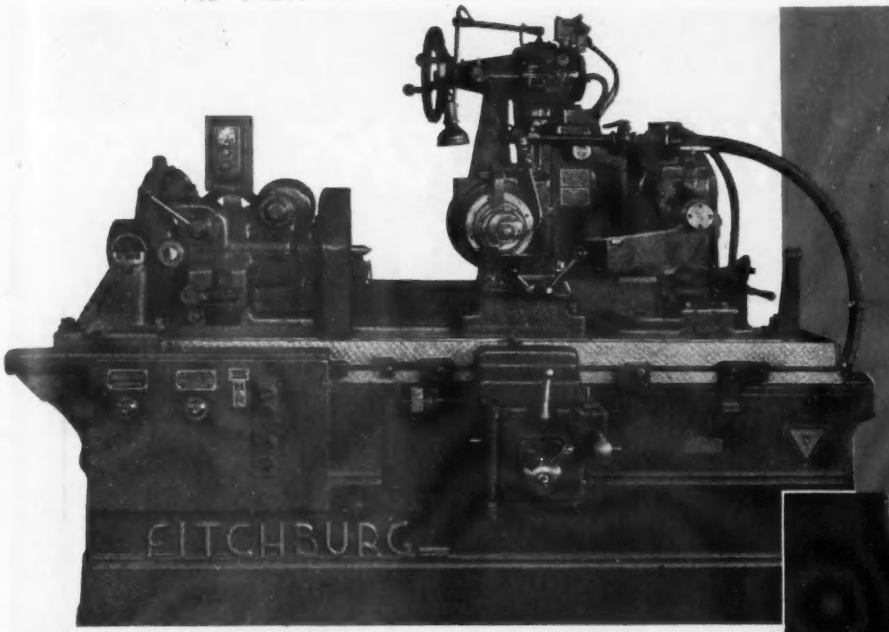

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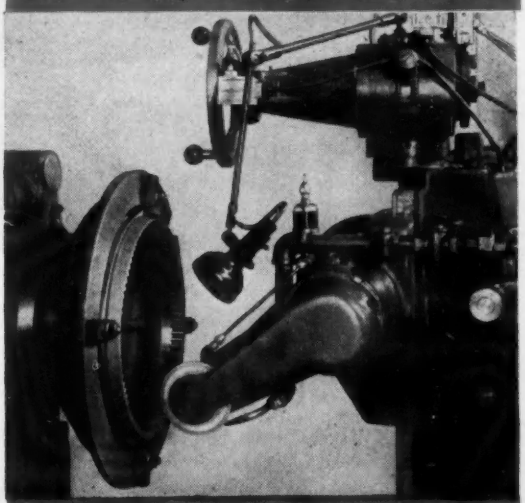

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A single Fitchburg Gear Grinder, with special attachments will

GRIND internal or external, helical or spur gears — straight, taper and helical splines, and will also

SHAPE straight, taper and helical splines.

A leading automobile manufacturing plant now engaged in making airplane engines, is using Fitchburg Gear Grinders with Special Wheelheads in the important operation of grinding internal gears. They give highest praise to its accuracy, fine finish and high production at low cost.

You can get the same results on a variety of work—on this one machine—why not let Fitchburg engineers show you how. Write today.

FITCHBURG GRINDING MACHINE CORP.

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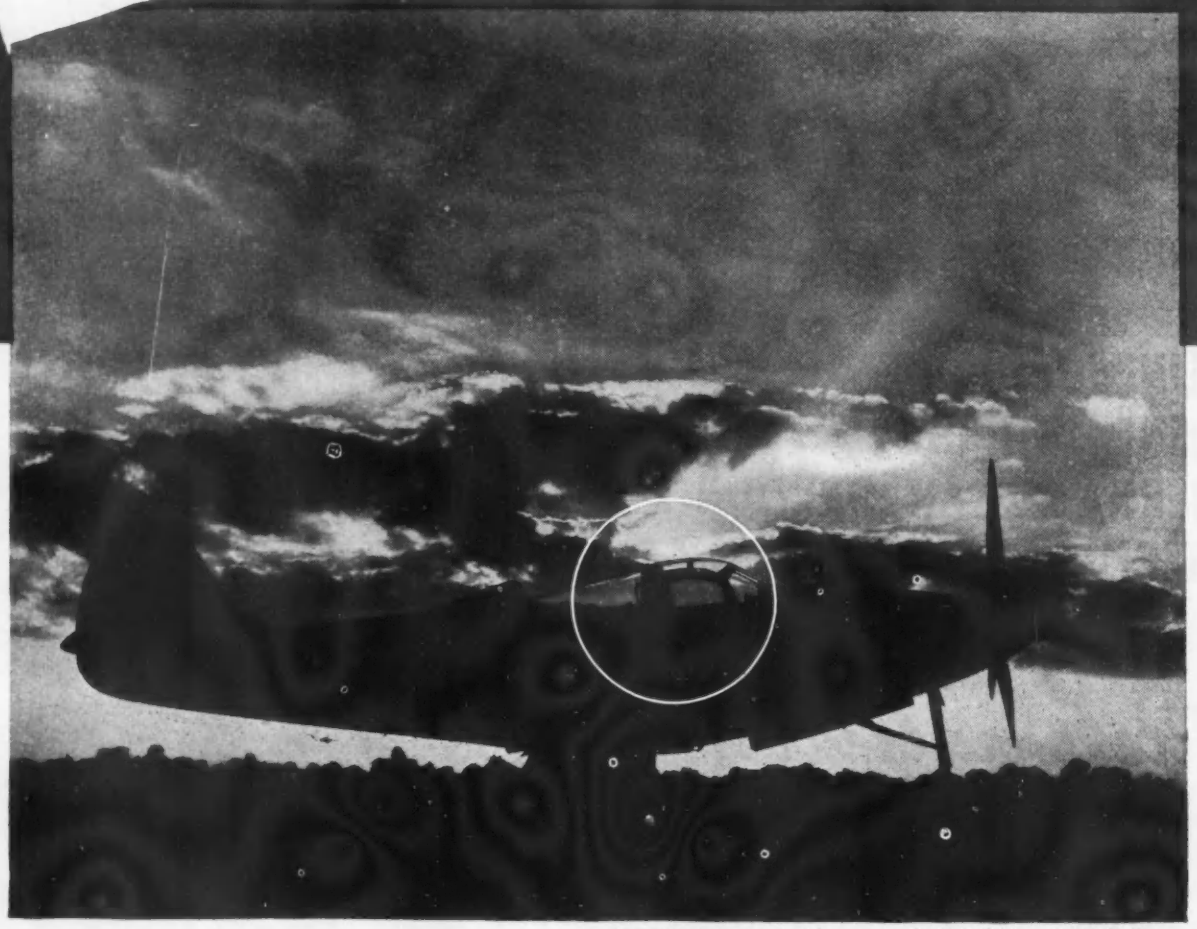
More information on crystal-clear Du Pont "Lucite" methyl methacrylate resin sheeting for aircraft designers, engineers, and suppliers of enclosures.

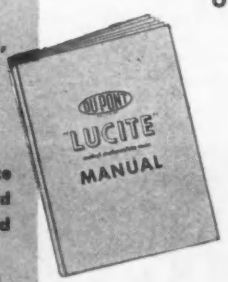
WHAT FACTORS AFFECT



SLEEPING GIANT of firepower, the Bell "Airacobra." Bell uses "Lucite" for all transparent sections of the P-39 cockpit canopy except the windshield. "Lucite" provides clear vision, streamlined contours, strength, and excellent aging characteristics.

WHY "LUCITE"?

"Lucite" is Du Pont's trade-mark for its methyl methacrylate resin, available in cast sheets, rods, tubes, large castings, and molding powders. Its standard color is clear transparent—over 90% light transmission. This feature—plus good characteristics of weather resistance, lightness, tensile and impact strength, satisfactory resistance to chemicals to which it is commonly exposed, and other properties, as well as its ease of forming and fabrication—commends the use of "Lucite" in aircraft applications. "Lucite" cast sheeting meets the U. S. Navy and Army Air Corps specifications, P41C (Grade A) and 94-120148.



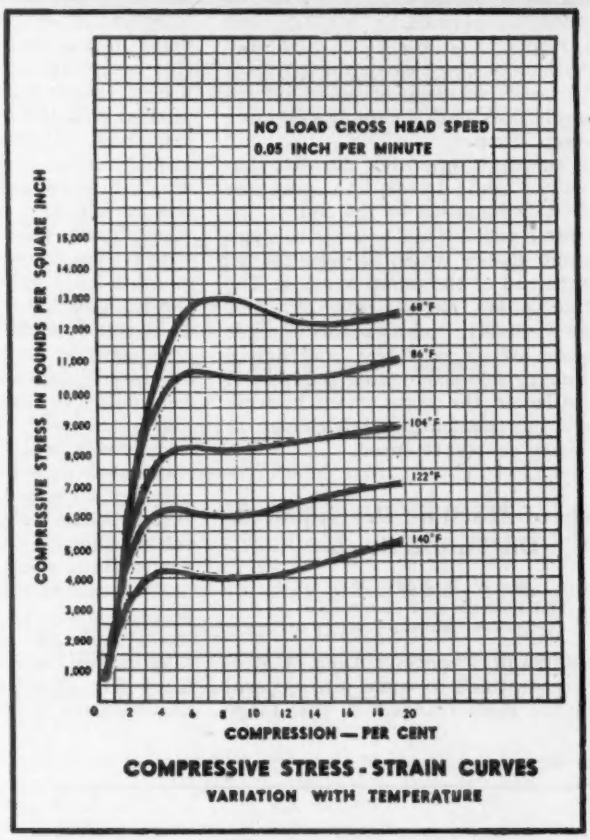
THIS FREE MANUAL CONTAINS OTHER IMPORTANT INFORMATION

The compressive strength of "Lucite," in combination with its many other desirable qualities, has led to its increasing use for aircraft enclosures. This 114-page aircraft manual on "Lucite" gives detailed information on fabricating, forming, repairing and general properties. If you haven't received your copy, write on your business letterhead to: E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J., or 5801 So. Broadway, Los Angeles 3, Cal. In Canada: Canadian Industries, Ltd., Box 10, Montreal.

THE COMPRESSIVE STRENGTH OF "LUCITE"?

The compressive strength of cast sheets of Du Pont "Lucite" methyl methacrylate resin at 77°F. and 50% relative humidity ranges from 10,000 to 12,500 pounds per square inch.

IN DESIGNING "Lucite" aircraft enclosures, allowance should be made for the effect of *temperature* on compressive strength. Data now available indicate that the presence of *moisture* has practically no effect. See graph of compressive strength in cast "Lucite" cubes tested by Du Pont plastics technicians at temperatures from 68° to 140°F.



COMPRESSIVE STRESS - STRAIN CURVES
VARIATION WITH TEMPERATURE

METHOD OF MEASURING COMPRESSIVE STRENGTH

Du Pont plastics technicians determine the effect of temperature on the compressive strength of cast "Lucite" by A.S.T.M. method D 649-41T. A one-half-inch cube is compressed in a standard testing machine, the load applied at 0.05" per minute. As the load is increased, the amount of deformation is read from a dial gauge and a stress-strain curve is plotted. The load at the point of rupture (or at the first maximum of the curve) is taken as the strength of the half-inch cube, and the compressive strength per square inch of the material is arrived at by multiplying this value by four. The test is repeated at various temperatures obtained by placing the sample and the plates that compress it in a bath of electrically heated mineral oil.

DU PONT
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Let's all BACK THE ATTACK!

DU PONT PLASTICS

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

SAE Receives Ordnance Award

(*Continued from page* 19)

unit, and is connected to it by a high pressure pipe.

A primary pump and a scavenging pump of conventional gear type are assembled as a complete unit in the same housing at the rear of the main pump body, and are driven by a common shaft. The primary pump, by means of a pressure regulating valve, maintains practically constant pressure on the supply fuel at all speeds and loads. The scavenging pump returns to the supply tank, all fuel by-passed at the metering assembly and the leakage fuel which escapes past the plunger and distributor valves. In connection with the scavenging pump, there is also a scavenging valve (see Fig. 6) which is installed in the leakage passage in the main pump housing. This valve automatically opens when the pump is in operation, permitting leakage fuel to be returned to the fuel tank, and automatically closes when the pump is not in operation, preventing fuel from the supply tank backing up and flooding the pump sump.

The camshaft operates the distributor valves and drives the governor shaft. It is installed in the top of the main pump housing and extends through the pump flange which is mounted on the front end of the pump housing. The governor shaft carries the governor weight assembly, operates the plunger by means of an eccentric, and drives the primary and scavenging pumps. It is installed in the main pump housing beneath the camshaft and is driven at four times camshaft speed.

Effects of Wartime Developments On Future Steels

By W. P. Eddy, Jr.,
GMC Truck and Coach Div.,
General Motors Corp.

HARDENABILITY specifications of steel are destined to come into general use in the near future. A few large users are already purchasing some steels to hardenability specifications, but the practice at first may be confined to widely used standard types. Better knowledge of their requirements by steel users and improved controls by producers will precede more general adoption. Contrary to a widely held idea, the highest hardenability steel available may not be the best, even though some parts must be hardened throughout. Since in most steel parts toughness is essential, future effects of recent developments in improving fatigue endurance are forecast, such as reducing alloy content of many heat-treated parts when deep hardening is not needed, more energetic opposition by designers to stress concentrators in highly stressed parts, and increased use of shot-peening.

Attention is called to the progress made in making annealing a more precise procedure than it has been. The use of radiographic techniques has expanded greatly and played an important part in promoting scientific approach to foundry problems. Improvements in castings as the result of their use in military vehicles and artillery, where properties closely comparable with those of wrought steel are demanded, have enhanced the possibilities for high-quality castings. Welding is no longer considered so much of an art as a science, largely as the result of outstanding advances in the spot-welding and arc-welding of armor and other highly stressed parts of carbon and alloy steels, which had previously been considered unweldable, at least so for primary structures. An accompanying sketch of the hull of a military combat vehicle shows an example of all-welded armor plate. (Fig. 7.)

Much self-education has already been accomplished in the choice of alloy steels and steel buyers are reminded that carbon may sometimes be substituted for alloying elements, provided heat-treating characteristics are understood. Under the sponsorship of Lieut.-Col. J. H. Frye, co-operating with a special American Iron & Steel Institute Committee under the chairmanship of John Mitchell and an SAE sub-committee, headed by R. B. Schenck, experimental projects that will add to the store of information on special addition agents such as boron, are under way. A conclusion as to the degree of permanency which NE steels will enjoy after the war is facilitated by a list of the considerations entailed. As for the substitution of non-ferrous metals for steels, this is likely to be largely temporary, just as that of steel for non-ferrous metals is expected to afford a clear picture only when normalcy and paramount consideration of economic factors are restored.

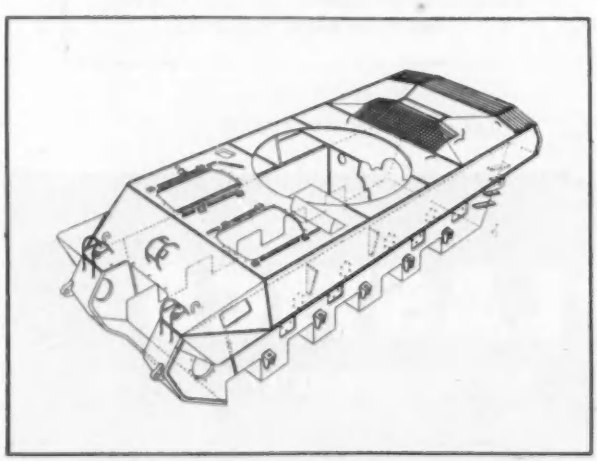


Fig. 7 — All-welded hull of an Army combat vehicle.

The Practical Postwar Car

By Edgard C. De Smet,
Executive Engineer, Willys-Overland Motors, Inc.

POSSIBILITIES of the Aluminum Body —Even if we adopt secondary aluminum for the majority of body parts and are able to realize thus a total reduction of 50 per cent in the present cost of aluminum, and if we discount the possibility of any reduction in the price of steel, the final cost ratio for a given assembly would still be 2½ to 1 in favor of steel. This penalty, which is taken directly on the raw material, would be considerably increased due to several factors which all tend to reduce the output of aluminum parts in comparison with the normal production of steel stampings.

In comparison with steel panels, which rarely fracture under average impact loads and which may usually be repaired by driving the metal back to its original shape, the hardened aluminum body panels and fenders will crack and tear under similar conditions, and bumping out is definitely out of the question.

In the event we decide that the saving in weight is of primary importance we could best take advantage of such substitutions by adopting aluminum, not for the body and sheet metal parts, but for the chassis parts such as castings, forgings and chassis members where the weight concentration is the greatest and where fabrication methods would not be materially affected by the change in material. The most advantageous substitution, from a riding quality standpoint, would be on the wheels, axles and all unsprung parts which should be reduced to a minimum in weight, whereas the body and other spring-supported parts should preferably be held within the accepted ratio of weight-to-volume in order to maintain proper road performance for the vehicle.

The Plywood Body — The one outstanding fact, which is also the greatest limiting factor in the fabrication of formed plywood parts, is that so far no one has yet been able to "stretch" wood. This means that practical forming,

HOW TO RESIST CYLINDER WEAR AND CORROSION!

SPECIFY C.W.C. CENTRIFUGALLY CAST CYLINDER LINERS!

C.W.C. cylinder liners and sleeves metallurgically engineered of electric furnace metal, alloyed or unalloyed, cast centrifugally in permanent molds, possess these engineering and production advantages:

- **Excellent machinability with high Brinell**
- **Higher wear resistance due to density and uniformity of structure**
- **Corrosion resistance through the use of alloys**
- **Requires no aging or seasoning because they stay put**

C.W.C. cylinder liners meet the most exacting requirements of engine builders in every field for equipment or replacement use in either wet or dry applications.

Consult C.W.C. engineers and metallurgists about your volume casting production problems.

Campbell, Wyant & Cannon foundries are located in Muskegon, South Haven (National Motor Castings Co.) and Lansing (Centrifugal Fusing Co.)
Industry's Leading Contract Foundry Organization

CAMPBELL, WYANT & CANNON FOUNDRY CO.

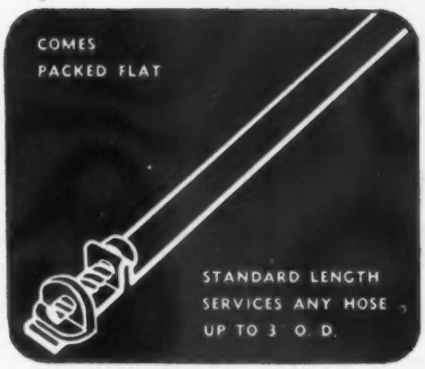
MUSKEGON, MICHIGAN

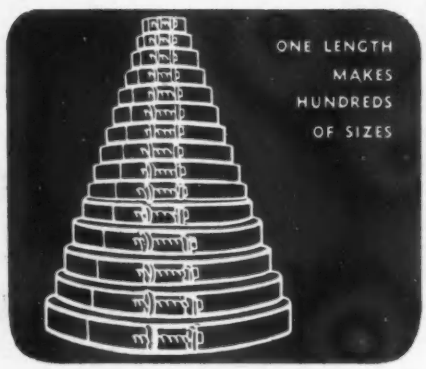
using uniform sheets for the plies, is confined to single-curvature surfaces often called "wrapped" surfaces, thus limiting the designers as well as the manufacturers to very simple formations and shapes. If plywood construction were used on automobiles, our designers would have to confine themselves to much simpler shapes and surfaces. Serious problems would also be connected with the assembly of the various units of the body to each other as well as to the auxiliary parts and also the mounting of those units to the main chassis structure.

The Plastic Body—The one-piece all-plastic automobile body is definitely out of the question, since it has been established that the production of pure homogeneous masses of plastic material is only acceptable, when confined to comparatively small, non-functional and non-stressed parts. At present, the chances for manufacturing, on a production basis, entire automobile bodies of laminated plastics of any kind are still very remote.

In regard to clear plastic enclosures, it has been recognized that the best flat sheet of transparent plastic that can be molded on a commercial basis is optically worse than the cheapest kind of window glass. When molded into curved shapes the optical conditions become impossible and all that has been said about the unfavorable properties of curved glass can be repeated on a magnified scale for curved plastics. Another major shortcoming of the clear plastics is their low factor of surface hardness in comparison with glass; they are subject to abrasion and surface scratches even under normal conditions. The simple operation of wiping off road dust with an ordinary cloth, or the action of the windshield wiper operating over the usual amount of dust deposited on the car or in suspension in rain water, will leave very definite marks which will multiply from day to day, until the material has lost most of its transparency.

Facts YOU SHOULD KNOW ABOUT CENTRAL UNIVERSAL HOSE CLAMPS





1. Central Universal Hose Clamps are made of rustproof, extra heavy, rolled steel. They can be attached or removed without disconnecting line. They can't strip or loosen, are leak-proof and 100% self-locking. They are standard for all hose and general connections.
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Army and Navy Jeeps, Ducks, Half-Tracks and other Mobile Units are equipped with Central Universal Hose Clamps.

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1018 So. Wabash Ave., Chicago 5, Ill.

Strength of Highly Stressed Dynamically Loaded Bolts and Studs

By J. O. Almen,
Research Laboratories Division, General Motors Corp.

TO ILLUSTRATE the effect of elasticity in bolted members and in the bolt itself, exaggerated cases are shown in Fig. 8. Example (A—Left) shows a bolt tightened against two stiff plates that are spaced apart by a low-rate spring. The external load is applied against the bolt by the two stiff plates. In this case the coil spring is a part of the bolted assembly and since it is very elastic as compared to the elasticity of the bolt for purposes of discussion, its rate may be considered to be zero. When an external load equal to the initial bolt tension is applied to the plates, the total bolt load will be twice the initial tension, because the spring load will not be appreciably reduced by the additional extension of the bolt and its load will be added to the external load. The stress range experienced by this bolt will be $1 - \frac{1}{2} = 0.5$.

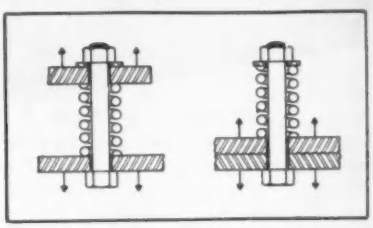


Fig. 8 Left—Spring is part of abutments. Bolt is weak. Right—Spring is part of bolt. Bolt is strong.

In example (B—Right) the external load is also applied to the plates, but the low-rate spring now is a part of the bolt instead of a part of the bolted assembly as before. We, therefore, have a very elastic bolt tightened against relatively very rigid members. When an external load equal to the initial bolt tension is applied to the plates, the load between the plates will be reduced to zero but the bolt will experience no appreciable change in load. The stress range will be $1 - 1 = 0$; that is, the load will be static and fatigue failure can not occur.

IMPORTANT NEW DEVELOPMENTS in Nitrocellulose Lacquers offer interesting postwar possibilities

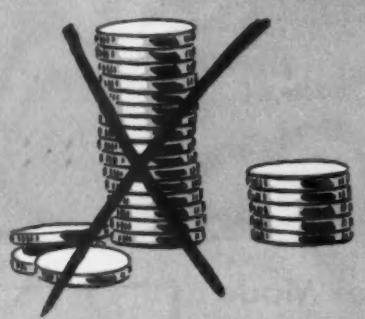
COMING ANNOUNCEMENTS

Important changes now in process promise new economy for high-quality finishes. These developments forecast an entirely new appraisal of nitrocellulose lacquers. For example . . .

EASIER APPLICATION

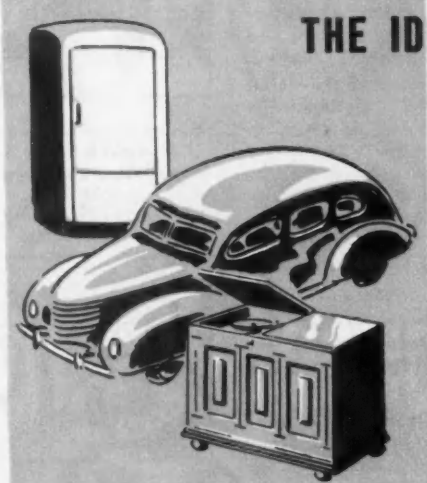
Experimental work on *higher solids content* indicates the use of nitrocellulose lacquer on a much greater scale. Promising new techniques point the way toward minimizing the number of coats required. This will result in extensive time and labor saving.

MINIMUM INVESTMENT



No special drying equipment is required, since nitrocellulose lacquer *air dries* in minutes. It therefore offers a decided investment economy to manufacturers "changing over." Fuel expenditures also are eliminated.

THE IDEAL POSTWAR PROTECTIVE FINISH



Tough, brilliant, durable, flexible . . . resistant to water and chemicals . . . unmatched in color possibilities . . . easy to apply and repair, nitrocellulose lacquer is the fastest drying finish known. In addition, it promises to be among the most economical to use.

Hercules makes no finished lacquers, but concentrates entirely on the production of high-quality nitrocellulose.

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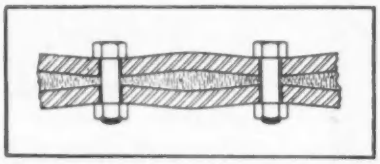


Fig. 9—Elastically deformed plates and gasket increase maximum and cyclic bolt loads. Bolts subject to fatigue.

While the arrangements shown in Fig. 8 are rather fanciful, we have assemblies in actual practice that are somewhat similar. Fig. 9 shows a condition frequently met in practice in which a gasket is clamped between two mating plates. The gasket is compressed locally opposite the bolt, thus bending the plates until they serve as the spring shown in Fig. 8 (A). When the external load is applied, the bolt will feel the elastic load of the bent plates plus the external load, a condition that invites trouble. Also in such assemblies the bolt or stud is usually short and relatively inelastic and we, therefore, have all the conditions necessary for large stress range and resulting fatigue failure. When gaskets are necessary, the gasket area should be large in the vicinity of the bolt and relatively smaller in proportion to the distance from the bolt, in order that the unit pressure on the gasket may be maintained with minimum bending of the bolted surfaces. The gasket should be as inelastic as possible and still serve its purpose.

A practical assembly having the characteristics of the assembly in Fig. 8 (B) is shown in Fig. 10, in which a spring washer is clamped between the bolt head or nut and the bolted assembly. When such a spring washer is dimensioned to support the required external load or the initial bolt tension, whichever is the greater within the elastic range of the washer, the effective bolt elasticity is increased and, therefore, the bolt fatigue strength is increased. Likewise any other expedient that will increase the rigidity of the bolted assembly or that will increase the elasticity of the bolt will increase the fatigue strength of the bolt. It is probable that in many instances spring members such as are shown in Fig. 10 can be profitably used.

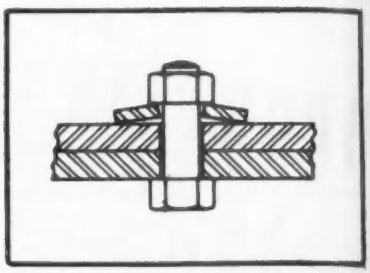


Fig. 10—Spring augments bolt elasticity. Bolt life is increased.

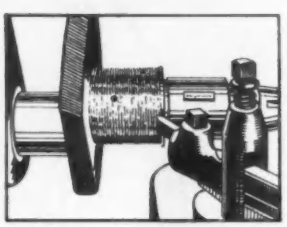
New Metal Surfaces Made by Spraying

Molten metal is now sprayed or atomized on to metal surfaces for the purpose of salvaging worn bearings, shafts, cylinder walls and such parts. Metallizing, as the process is called, is also used for putting a non-corrosive coating on iron or steel surfaces subject to corrosion such as cylinder walls of internal combustion engines, valve gates and such parts in contact with water. The metals to be sprayed may be aluminum, zinc, stainless steel, high carbon steel or other alloys depending upon the character of the surface desired. The sprayed surface may be "over built" and machined down to size to obtain accurate surfaces.

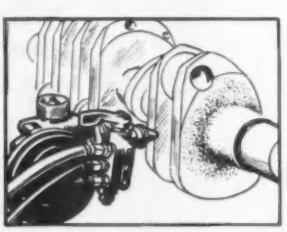
Metal spraying guns have been perfected for use with various types of gases for heat, depending upon the melting temperature of the metal to be sprayed.

We hope this has proved interesting and useful to you, just as Wrigley's Spearmint Gum is proving useful to millions of people working everywhere for Victory.

You can get complete information from The Metallizing Company of America, 1330 W. Congress St., Chicago, Illinois.



Rough threading—cooling locks metal firmly to surface, producing a permanently tight bond.



Sprayed journal before finishing—Main bearing journal after surface has been Metallized.

Y-101

L-Head Engine Problems Due to Continued Increases in Compression Ratio

By E. J. Willis,
Aluminum Company of America

IF THE best premium fuel available to the public after the war will be approximately 80-octane, extremely high compression ratios of 9 and 10 to 1 are immediately ruled out since there is little advantage to be gained in either overhead valve or L-head engines with this type gasoline. It would seem that the number of difficulties in operation for the average driver precludes the use of ratios much over 8.5 to 1 in either type engine. It is practical to design relatively simple combustion chambers for L-head engines at this compression ratio. The following design changes, as indicated by experimental tests, will prevent the transfer area between the valve end of the combustion chamber and the piston end from becoming a bottleneck to efficient design at this compression ratio:

I. Tilting the axis of the valve center line toward the cylinder center line at the top of block shortens the combustion chamber length and makes the chamber more compact.

II. A nib protruding from the top of the combustion chamber dome containing the spark plug is of marked advantage in increasing fuel economy and smoothness of operation. The only

Official U. S. Navy Photograph

ON LIGHTER, STRONGER TIRES

UNITED STATES RUBBER COMPANY

1230 Sixth Avenue · Rockefeller Center · New York 20, N. Y.

On Carrier Deck or Desert Sand
LIGHTER AIRPLANE TIRES CARRY HEAVIER LOADS

Official U. S. Navy Photograph

When the tires on Navy fighters smack the carrier's deck, they shoulder a load far greater than tires of their size were originally engineered to take. Added weight of armor, increased load of fuel and ammunition, greater speed, range and fire-power demanded tires that could take it. That's why airplane tires had to be built lighter, stronger, tougher than ever before. On desert sands, on steel runways, or on icy landing strips, there is a U.S. Royal Airplane Tire especially designed and engineered to do every job.

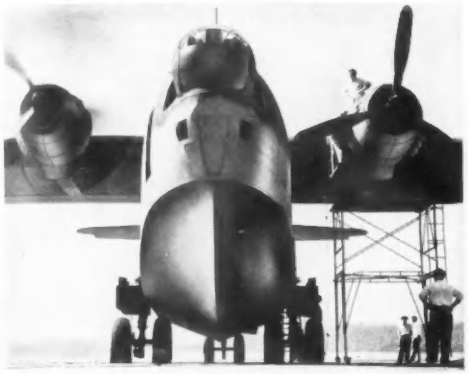
1230 SIXTH AVENUE **UNITED STATES**

For Flight Deck Landings

THE U. S. ROYAL

High Pressure Channel Tread

Tail wheel tires on carrier-based planes like the Vought Corsair have to take the shock of flight deck landings and at the same time hold the plane under control with minimum bounce. U. S. Channel Treads keep rebound at a minimum, withstand the high temperatures of fast stops, and track straight without dangerous skidding. The broad, flat tread gives better flotation on soft or sandy soil, too.



For Beaching Flying Boats

THE U. S. ROYAL

Beaching Gear Tire

Tires for beaching gear must be able to shoulder the great weight of these giant boats. Since these loads are sustained at low speeds with few sudden shocks and strains, U. S. Beaching Gear Tires are engineered to handle loads far in excess of those carried by conventional tires. For easy installation, the U. S. Royal Beaching Gear Tire is equipped with a special water valve so that the tire may be partially inflated with water.

For Tri-cycle Landing Gear

THE U. S. ROYAL

Low Profile

Nose Wheel Tire

The U. S. Royal Nose Wheel Tire is engineered for the special operating conditions of tri-cycle landing gear. The tire has an unusual cross-sectional shape, extra wide at the rim with less than normal distance between the rim and the tread contact area when inflated. Should the nose wheel be damaged or fail on landing, the drop is reduced to a minimum.

For High Brake-Heat

THE U. S. ROYAL

Fabric Base Tube

Excessive use of brakes often causes overheating. Tubes of standard construction may not stand up under these conditions. "U. S." Field Airplane Tire Engineers developed the U. S. Royal Fabric Base Tube that can take high brake drum heat for as much as 450 to 500 hours when tubes of conventional construction often fail in less than five hours.

RUBBER COMPANY ROCKEFELLER CENTER, NEW YORK 20, N. Y.

They Look Alike But One Tire Has 64% More Strength

These three U. S. Royal Airplane Tires look alike. And yet what a difference there is—an all important difference that means thousands of pounds of extra fighting power.

The Army and the Navy needed tires that could carry the greater loads of today's long range air warfare, tires of vastly greater strength and reduced weight. Overall size could not be increased. Drawing on their experience in pioneering the rayon cord tire, "U.S." Airplane Tire Engineers developed a new tire built with nylon cords. Weight was reduced 16% from cotton cords and strength increased 64%. Today, these giant Nylons are serving on Army and Navy planes under the toughest landing and take-off conditions, pointing the way to the stronger, lighter, better airplane tires for the future.

Listen to the New York Philharmonic Symphony broadcast over Columbia network every Sunday afternoon 3:00 to 4:30 P. M. Eastern War Time.

UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE · ROCKEFELLER CENTER · NEW YORK 20, N. Y.

disadvantage seems to be that a small spark plug must be used for the maximum benefit.

III. Extending the piston upward into the combustion chamber allows the maximum transfer area at increased compression ratios. This also shortens the flame travel still farther.

It has been found many times that the simple change to higher compression ratios with spark setting for light detonation under full load conditions shows little increase in performance, certainly not enough to warrant ratios over 8.5 to 1. More improvement in fuel economy can be made by advancing the spark timing under part-throttle conditions than by increasing compression ratios. The public desires an L-head engine which is smooth-running at moderate compression ratios, with the spark controlled for maximum gasoline mileage under all conditions of operation.

There is a tendency toward lower rear axle ratios for fuel economy reasons. Assuming that maximum engine speeds will be about 3500 rpm, it is possible to restrict the intake manifold so that the maximum breathing capacity of the engine coincides with this maximum engine speed. This will allow smaller intake manifolds and better carburetion. Part-load economy is definitely increased and extreme spark advance under part-throttle conditions is more easily attained. Extremely good gasoline mileage will result by these changes.

Postwar Utilization of Aluminum and Magnesium

By L. W. Kempf,
Aluminum Research Laboratories,
Aluminum Company of America

THERE will be available in the future, two types of aluminum: One, primary metal as it comes from the reduction pots and containing a few tenths of a per cent each of iron and silicon. There will also be secondary aluminum recovered from used metal. It will contain, in general, between 3 and 4 per cent copper, and 1 per cent or less each of silicon, iron and manganese, with smaller amounts of magnesium and nickel. This conclusion is drawn from a consideration of the alloys now in largest production.

Judging from past history, secondary metal will play an important part in any large-scale use of aluminum alloys in automobile construction. In the past, the price of secondary has for long periods of time been between 1/3 and ½ that of primary. It may be assumed, therefore, that secondary aluminum will be available at a price of the order of magnitude of 5 cents per pound after the war. Five cents per pound for aluminium is equivalent to 1¾ cents per pound for iron. The metal cost for automobile castings in aluminum thus will reach the same general level as the metal cost for iron castings.

It is not to be expected that the cars made in the first year (and perhaps most of the second year) following the war will use aluminum in many new applications. The cars built in this period will be essentially the same as manufactured before the war. However, in the third year following the end of hostilities in Europe new designs will be coming out, and for these designs aluminum quite properly should be considered. By this time also the wave of secondary will be building up which will reach large proportions about five years after the war.

Judging from the composition of secondary metal which will probably be available, it should be possible to make wrought products which will develop in the fully heat-treated condition tensile strengths of the order of 60,000 or 65,000 psi, with elongations in the neighborhood of 10 per cent to 15 per cent. The situation with respect to casting alloys is somewhat different from that of wrought alloys. The composition of wrought alloy scrap will not be satisfactory for the production of commercial castings. Magnesium content is too high for satisfactory toughness and ductility. However, the magnesium content can be reduced during the recovery melting operations to less than 0.1 per cent. Either copper or silicon or both must be increased if the alloys are to be commercially castable. Alloys of such composition could be heat-

treated to tensile strengths of about 35,000 psi, providing low ductilities could be endured. On the other hand, if maximum ductility is desired, the castings could be annealed with the achievement of something in the neighforhood of 23,000 to 25,000 psi tensile strength and 2 per cent to 3 per cent elongation. Undoubtedly, the aluminum automobile castings of the future will be made from alloys like these rather than from the old No. 12 type containing about 8 per cent copper.

Fabricating costs—The recent tenfold expansion in the production of practically all aluminum commodities has enabled operations to reach a unit size where marked fabrication economies should be evident. There would appear to be no fundamental reason why the fabrication costs on aluminum alloy cylinder block should be particularly higher than the cost of producing the same casting in iron.

Use of Magnesium—For the immediate future, the cost of primary magnesium on a volume basis will probably not be any lower than that of primary aluminum. No large secondary market has been built up which might serve as a source from which low-cost magnesium alloys could be obtained. In addition, the fabricating characteristics, both casting and working, are inherently poorer and thus more costly than those of aluminum. It is true that in some cases, heat-treated, high-strength magnesium castings can be produced for about the same piece price as heat-treated high-strength aluminum castings. This is, however, not true when the comparison is made on the basis of aluminum alloy castings made from secondary metal.

Design Details of the Mosquito Warplane

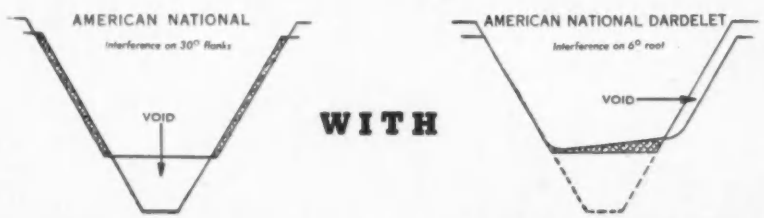
By R. B. McIntyre,
De Havilland Aircraft of Canada, Ltd.

Wood monocoque construction is used to expedite progress from design to construction stages, to provide a structure with better elastic stability than metal, to permit of quick and easy repair, and to make use of fresh labor groups and new material supplies. Development of the plane represents neither secret processes nor revolutionary devices, but long design experience and careful attention to details which give it remarkable speed and fighting ability, as well as light handling and flying qualities.

The fuselage, constructed of two thicknesses of plywood supported by a core of balsa wood, all phenolic bonded. In production the monocoque is built in halves, permitted much of the equipment to be fitted before joining the halves by plywood lap strips. The continuous wing requires only four fuselage attachment points, two fittings being fixed, the others adjustable both in production and in field maintenance. Concentrated loads arising from engine, undercarriage, radiators, and fuselage are conducted into the primary wing structure by metal fittings bolted through Bakelite blocks into ribs or spars.

Glued members are additionally joined by woodscrews driven to just below surfaces, with depressions filled with acetate stopper and the entire skin sanded smooth. Protection against the effects of moisture is provided by ample ventilation and drainage, as well as by fabric coatings and sealer. The tremendous speed is ascribed in part to freedom from parasite drag and elimination of external rivet heads and small protuberances, and by the smooth wetted fabric-covered, doped, and sanded surface. Field repairs are made by journeyman carpenters who splice new pieces of timber and plywood into position, patch bullet holes, replace damaged wood with wood of the same species, grain direction, and quality. (An engineering description of the Mosquito was given in the June 15, 1943 of Automotive and Aviation Industries).

ELIMINATE STUD TROUBLE



AMERICAN NATIONAL DARDELET THREADS

The American National Dardelet stud can be produced with minimum tool and gage alteration and incorporates the following advantages:

★ Eliminates lateral motion which results in fretting in service.

★ Overcomes galling during stud assembly.

★ Reduces the necessity of selective fits.

★ Seals against leakage through the thread fastening.

★ Greatly increases resistance to fatigue.

★ Increases strength in tension and torsion.

★ Is economical in production—Inspection simplified.

★ Can be driven into an A.N. tapped hole after reaming.

★ Design features have proven ideal for rolling.

•

A.N. FORM + DARDELET — A.N.D.

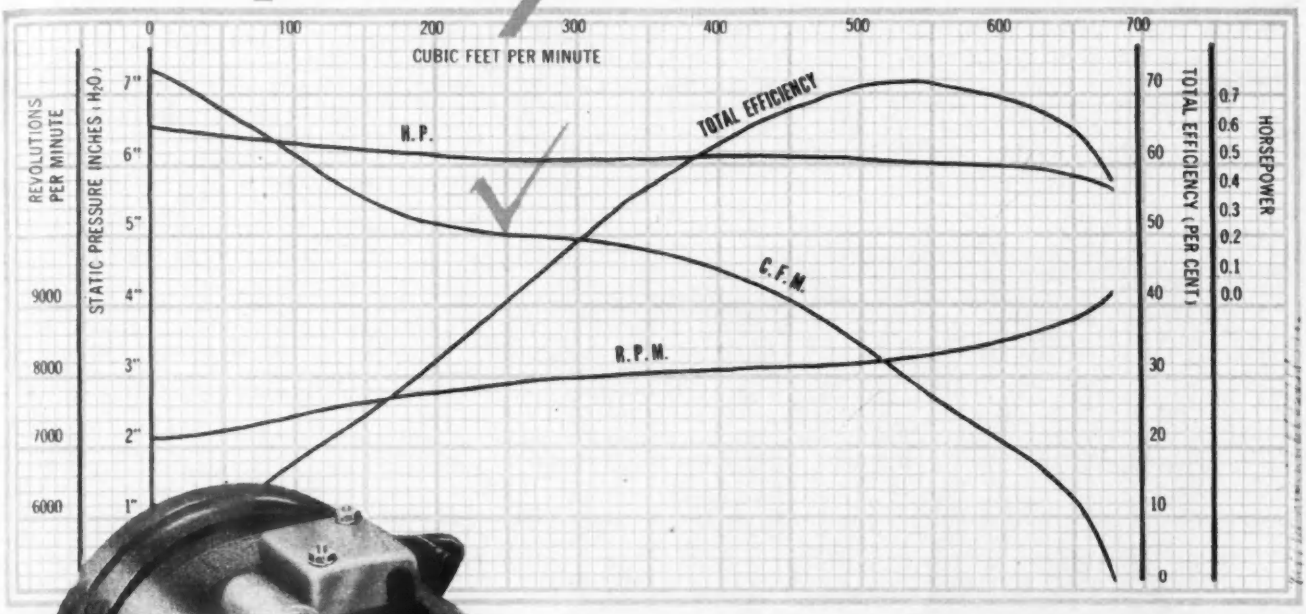
DARDELET THREADLOCK CORPORATION

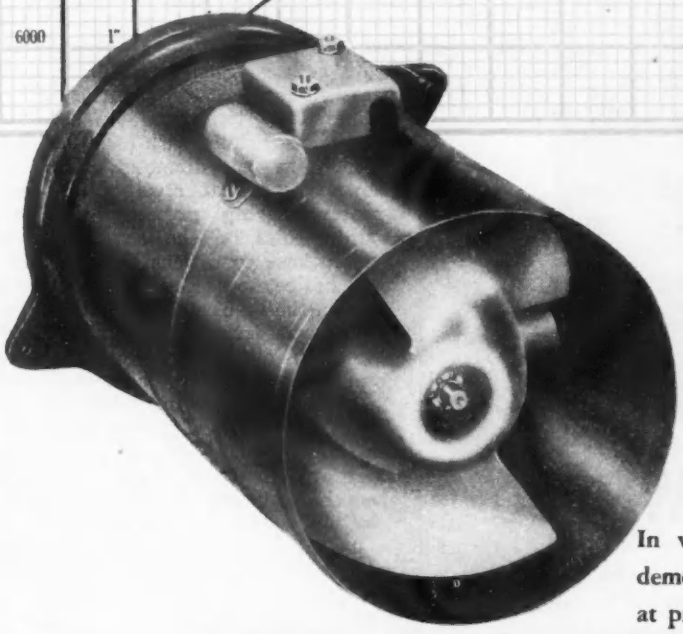
2832 E. Grand Boulevard, Detroit 11, Michigan

Back the Attack

with War Bonds

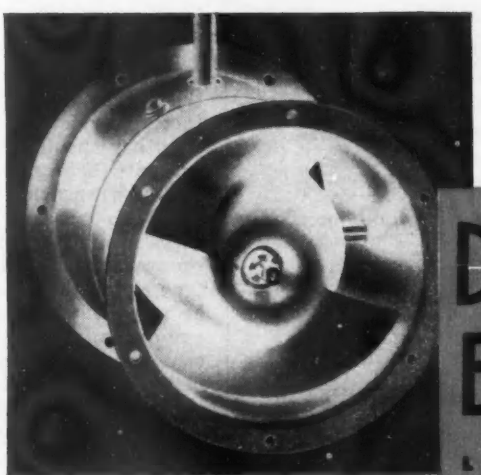
COMPARE AXIAL FLOW *performance*





THIS 2-STAGE UNIT, 6" DIAM. WEIGHS ONLY 8 LBS., YET IT DELIVERS 250 C. F. M. AGAINST A STATIC PRESSURE OF 5"

In wartime performance, Dynamic Air axial flow fans demonstrate highly engineered efficiency. They deliver air at pressures once considered limited to centrifugal blower capacity. But their precision, and economy of space, weight and power are not restricted to planes and ships. Six inches—or six feet—in diameter, they serve industry just as well. Our 11 years' experience is ready to serve you. Write us. Catalog sent on request.



Principles of axial flow can be applied to any problem of moving air with more efficiency at less cost. This 5" marine fan, using .05 H.P., moves 270 C.F.M. free air. Larger units reflect similar savings. Let us work out your special problem.

DYNAMIC AIR ENGINEERING Inc.

LOS ANGELES, U. S. A.

DESIGNERS and BUILDERS of HIGH EFFICIENCY AXIAL FLOW EQUIPMENT

Requirements for Light Drive Fits

(*Continued from page 25*)

exact pressure required to push steel and duralumin bolts of varying diameters into a hole of fixed size in a typical assembly.

Quality control applied to the bolts revealed that a good many had diameters below the low limit set on the NAS drawings, and that the duralumin bolts varied in diameter from the nominal to 0.0012 in. less than nominal, which was 0.0007 in. less than the specified low limit. It was thus impossible to establish a hole or reamer size on the basis of the NAS drawing, as it was not possible to secure bolts to the tolerances specified. It was then decided to use steel bolts of diameters down to 0.0006 in. below the nominal. The 300 bolts used as samples were sorted by the Inspection Department into groups varying in diameter by 0.0001 in.

The hundred reamers returned from the production line were tagged to indicate the number of holes which had been properly reamed with them. Some reamers had been used to ream only two holes, and had then failed to cut. The maximum life of any of these reamers was 100 holes. These differences in the life of the reamers were due to rough or wrong-size pilots, camber, absence of relief (which caused dragging), roughness on the tapers, and dull faces.

The rough and finish reamers used in the tests were ground as specified in Fig. 2, and with these reamers a number of men were able to produce holes within 0.0001 in. of the reamer diameter, at a speed of 200 rpm and with SAE No. 10 lubricant.

Steel and duralumin bolts varying in diameter by 0.0001 in. were driven with a 6-oz hammer by a number of production men, and all agreed that a maximum interference of 0.0006 in. still resulted in what might be described as a "light-drive" fit. A steel bolt giving an interference of 0.0007 in. could still be driven with the 6-oz hammer, but it was decided that the fit was too tight to be classed as a light-drive fit.

As may be seen from Table I, the pressure required to drive the bolts, as indicated by the tensile machine, increased materially with each 0.0001 in. increase in bolt diameter. It is also shown there that steel bolts require greater driving pressure than duralumin bolts of the same diameter. Under these conditions the light drive fit is subject to various interpretations.

From the results of the tests the conclusion was drawn that it is impossible to obtain either steel or duralumin bolts to meet tolerance specifications of + 0.0000 — 0.0005 in. The tests indicated that steel bolts having a tolerance of + 0.0000 — 0.0006 in. are suitable for light-drive fits if the reamer sizes shown in Fig. 2 are used, and that duralumin bolts with tolerances of + 0.0000 — 0.0012 in. are acceptable, provided they are divided into two size groups differing in diameter by 0.0005 in. These bolts should be graded by means of visual-inspection precision gages.

Reamers ground in accordance with the specifications in Fig. 2 and used at the specified speeds will have a satisfactory service life. To prevent cambering, they should be circle-ground on an accurate set-up, and indicator gages should be provided for gaging diameters. To increase the life of reamers, they should be designed without a square at the chucking end for a better grip on the shank, and cases should be provided for them to prevent damage due to rough handling. A 100 per cent inspection should be applied to both new and resharpened reamers, to check their conformance to Fig. 2 and Table II. Referring to the suggestion that duralumin bolts be graded into two size groups, it would be desirable to give each group a distinctive color marking.

an ANTI-FRICTION WORLD

EVERY HEADLINE PULLS IT CLOSER TO REALITY—a world that will benefit from the brilliant inventive triumphs of war production; truly an Anti-Friction World. We know . . . for Aetna is helping to plan and achieve it.

Scores of new products, hundreds of old products redesigned; will operate more smoothly, more economically—countless war-worn plants will be revamped, rejuvenated: all by judicious application of anti-friction bearings.

Have you made sure that your product and your plant will be ready for tomorrow's competition?

Aetna can help you. Time used for laying solid foundations of your future business is time well invested. A line or call to us makes the contact. Aetna Ball Bearing Manufacturing Company, 4600 Schubert Avenue, Chicago, Illinois.

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THRUST BALL BEARINGS,
Standard and Special
ANGULAR CONTACT
BALL BEARINGS
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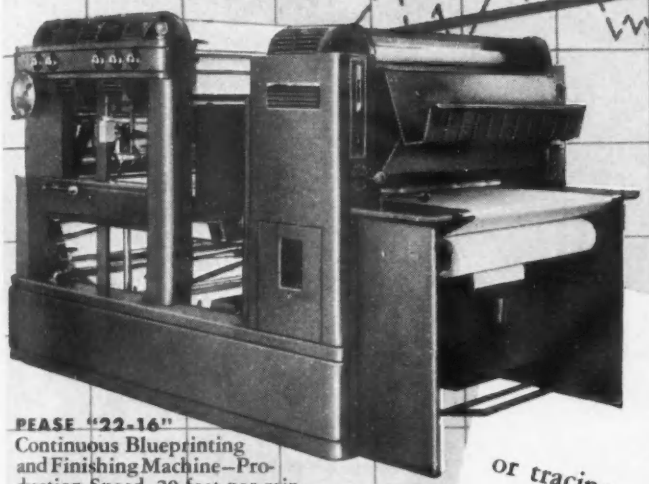
GROUND WASHERS

IN DETROIT: SAM T. KELLER, 7300 WOODWARD AVENUE. PHONE: MADISON 8840-1-2.

Aetna BALL BEARINGS

Blueprints

SMOOTH OUT PRODUCTION KINKS



PEASE "22-16"
Continuous Blueprinting and Finishing Machine—Production Speed, 20 feet per minute. (Model "22," not shown, has a Production Speed of 30 feet per minute.)

EXCLUSIVE PEASE FEATURES

- **Sliding "Vacuum-like" Contact** smooths out tracings, prevents errors in printing.
- **Three Speed Lamp Control** provides operation at 10, 15, or 20 amperes, minimizes running speed and dryer heat changes.
- **Actinic "No-Break" Arc Lamps** burn for 45 minutes without breaking arc, resume instantaneously.
- **Horizontal "Floating" Water Wash** floats prints free from tension and prevents wrinkles, stains, bleeding.
- **Quick Change Chemical Applicator System** very economically allows change from Blueprints to Negatives in 20 seconds.
- **Eight-inch Diameter Drying Drums,** thermostatically controlled, heated by gas or electricity, dry the prints "flat as hung wallpaper."

Blueprints are accurate, easy to read and faithfully reproduce every detail of the original engineering drawing or tracing... Blueprints remain legible and withstand the rough handling, dirt and greasy fingerprints of shop use... Blueprints produce good prints from poor, worn, or soiled tracings... That is why Blueprint reproductions of drawings and tracings are now used more than ever before.

Pease Continuous Blueprinting Machines are simple in operation and combine printing and finishing in one complete continuous operation. They smooth out "production kinks" with their own actual production speed of 30 feet per minute in the case of Pease "22" (not shown) and 20 feet per minute with Pease "22-16."

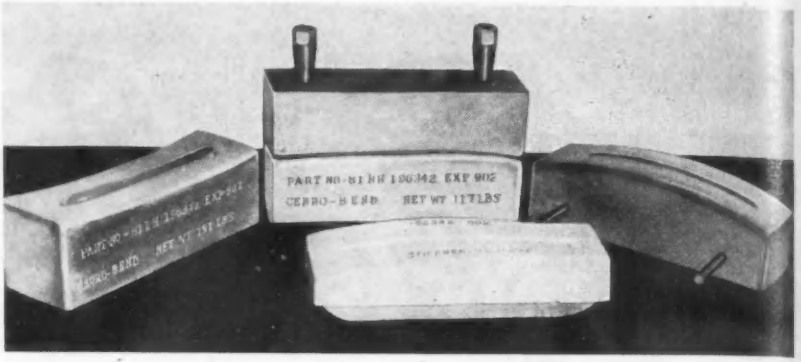
THE C. F. PEASE COMPANY
2635 WEST IRVING PARK ROAD • CHICAGO 18

Pease Blueprinting Machines A TYPE AND SIZE FOR EVERY REQUIREMENT INCLUDING DIRECT PROCESS PRINTING AND DEVELOPING MACHINES

Making Prototype Dies

(*Continued from page* 41)

on the part. The dies are cast directly from standard size plaster patterns of the part, in a large tank containing circulating, cooling liquid. The cooling of a die is accomplished in approximately 45 min. The metal used, a standard, low melting point alloy known as Cerrobend, can be pumped through a long rubber hose to any job that is ready for pouring. As Cerrobend cools it doesn't shrink which eliminates all problems of machining.



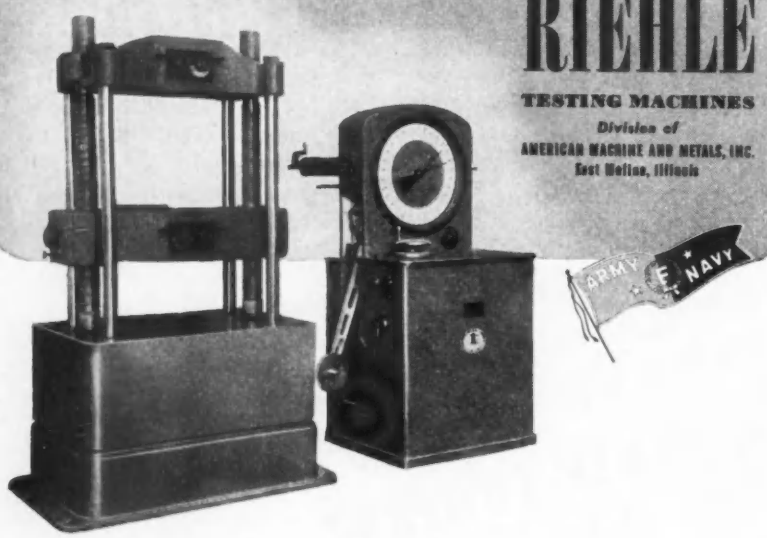
Cut shows on the left solid Cerrobend male punch; center, foreground is original plaster model; center background is the die set—(punch & die) showing location for drop hammer mounting. Right, solid Cerrobend female die.

Anchor lugs and cores for holding the die in the drop hammer are mounted and cast in place during the pouring. Fitting of templates and all grinding, filing, chipping and polishing operations are unnecessary. The desired thickness of the metal is added to the die by means of a special spraying technique. Aluminum, steel or plastic parts can be made in quantities of from one to 50 or more, depending on the type of material, thickness and accuracy required.

PRECISION
HYDRAULIC TESTING MACHINE
with Pendulum Load Indication

MORE ACCURATE, MORE DEPENDABLE FOR PRODUCTION TESTING because:

Pendulum load indicator operates on the natural laws of gravitation. ...This principle of operation is not affected by temperature changes or subject to metal fatigue....*Write for descriptive literature and quotations.*



RIEHLE
TESTING MACHINES
Division of
AMERICAN MACHINE AND METALS, INC.
East Moline, Illinois

Other Products: IMPACT TESTERS · VICKERS HARDNESS MACHINES · BRINELL HARDNESS TESTERS · MEASURING INSTRUMENTS

Titeflex Metal Hose Co. Changes Name

The Titeflex Metal Hose Co. of Newark, N. J., will hereafter be known as "Titeflex, Inc." Since 1914, the Titeflex Metal Hose Co. has specialized in the manufacture of flexible metallic tubing for the conveyance of fluids and gases for general industrial and automotive application. More recently, Titeflex, Inc., has become the largest producer of radio and ignition shielding for aircraft and automotive engines.

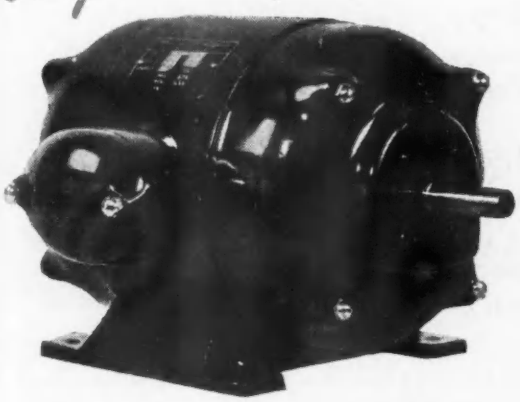
The change of name to Titeflex, Inc., has been made with the realization that "Titeflex Metal Hose Co." is no longer descriptive of all the products manufactured by the company.

Advertising Note

Tube Turns and the Girdler Corporation, Louisville, Kentucky, announce the appointment of Gene Wedereit as advertising manager. Formerly vice-president, and director of creative service with the E. F. Schmidt Co., of Milwaukee, Wedereit came to Louisville recently as a result of his work in the designing and production of Tube Turns' 240-page catalog. Walter Girdler, Jr., formerly advertising manager, is now director of personnel.

"You'll sleep like a log"

Horsepower by Howell



The Howell Protected Type Motor, shown, gives complete protection against dripping liquids, metal chips and other falling particles. Completely streamlined — utilizing non-breakable steel frame — malleable or steel base — cast iron end plates and cast iron, weatherproof terminal box are standard construction features. Special horizontal and vertical mountings are available.

Available in sizes 5 H.P. and smaller.

SUPERINTENDENT: I'm counting sheep, worrying about my production problems, and you butt in!

HORSE: Super., I've got a suggestion — a hot tip —

SUPERINTENDENT: Come, come, be brief. I'm tired!

HORSE: Well, well, that's too bad. But Horsepower by Howell would put an end to all those electric motor problems in your plant. All Howell specialized motors and standard motors are engineered and precision-built for the *hard* jobs. Your jobs will be easy for these quality motors.

SUPERINTENDENT: Really? Maybe I can stop worrying.

HORSE: You bet you can! Folks quit worrying when they buy Howell Motors. They know they have a precision-built, properly insulated, quieter operating motor. With Horsepower by Howell in your plant, you'll sleep like a log.

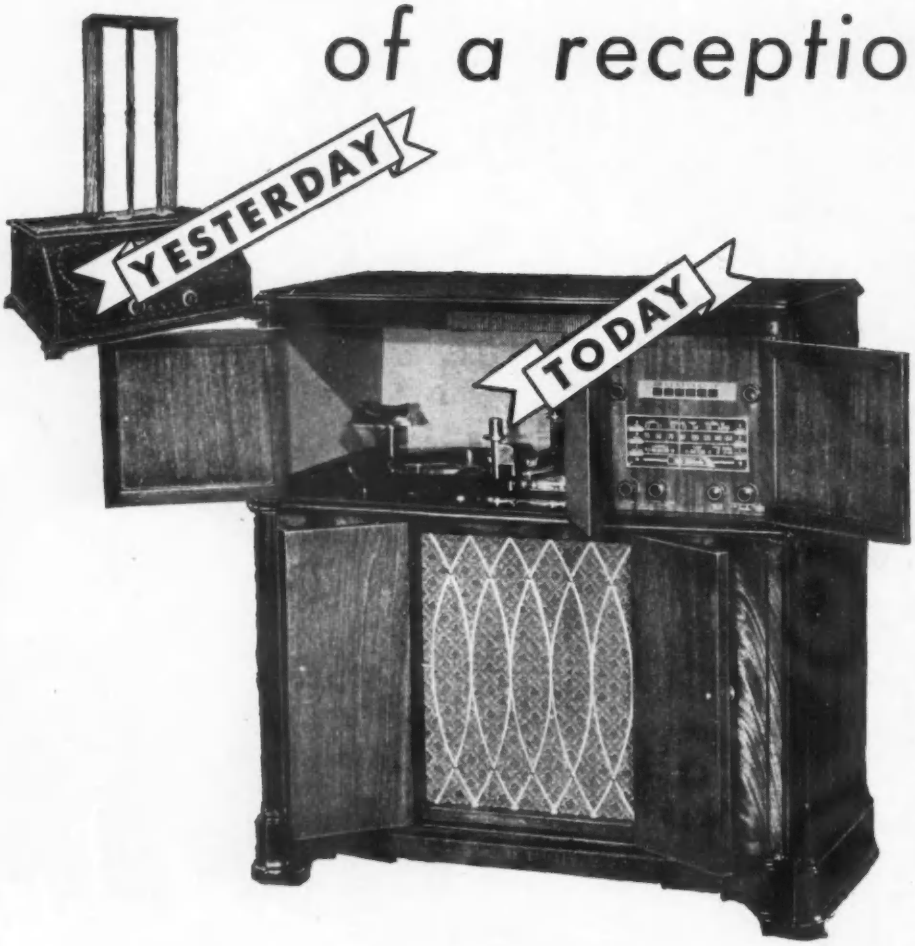
Making postwar plans? Phone the nearest Howell representative or write the factory. Your inquiry will put our experienced engineering staff and complete facilities to work for you.

HOWELL ELECTRIC MOTORS COMPANY

HOWELL, MICHIGAN

Manufacturers of Quality Motors Since 1915

Yesterday *wouldn't get much of a reception* TODAY



TOMORROW

Yesterday's radio would fall far short of doing justice to today's broadcasts. Few of us would have the patience to fool around with numerous dials to keep a station tuned in properly. Improved Electrical Insulating Materials have made an important contribution to the performance of today's radios, whether in use by our Armed Forces or by civilians.

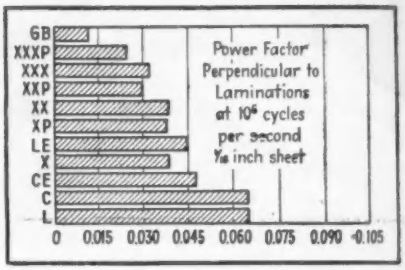
The C-D Laboratory has made it unnecessary for Electrical and Design Engineers to "fool around" experimenting with numerous types of electrical insulating materials. C-D has developed grades and types of electrical insulating materials to meet specific and special problems. The "know-how" accumulated through solving thousands of electrical insulating problems is at your disposal to help you solve the question "What Insulating Material?"

CC-43

POWER FACTOR VALUES IN DILECTO Laminated Phenolics*

Power factor may be considered an indication of the stability of the insulating material in question or a check of the uniformity of specimens. In some cases it is desirable to have low power factor, while in others it is not so important. In all cases, however, it is a useful means to indicate purity of composition and useful life under electrical stresses, as well as the efficiency of the insulator.

POWER FACTORS FOR STANDARD DILECTO GRADES



One of the standard test methods for power factor is called the "Resonant Circuit; Resistance Variation Method." Measurements are at 10^6 cycles per second. Equipment consists of a stable high-frequency generator, a vacuum tube voltmeter, decade resistors and a standard precision-type variable air condenser. Below, Mr. Freed is seen operating this equipment.

* Excerpts from an article on POWER FACTOR TESTS by J. R. Freed of the Continental-Diamond Laboratory Staff. A copy of the complete article will be sent on request.

Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

Exide
HEAVY DUTY
BATTERIES

Plenty of "GO" at 20 below!

Sub-zero weather does not phase an Exide. These rugged batteries are scientifically constructed to give peak performance in any climate. And in "Off-the-highway" operations, that's mighty important. For, without question, the efficient operation of snowplows or shovels, compressors or cranes, tractors or trucks depends upon starting equipment that is built to take it.

Day after day, regardless of the temperature, you can depend on your Exides for faster cranking. They are durable and dependable, built for long-life, and simple to maintain.

BUY TO LAST
SAVE TO WIN

Write for a FREE copy of the Exide catalogue on Heavy-Duty Batteries. It tells you what to order, how to order, and how to get the most from your Exide Heavy-Duty Batteries. Write today!

THE ELECTRIC STORAGE BATTERY CO., Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

Landing Wheel Castings

READY FOR SHIPMENT TO Firestone Aircraft Company

HILLS-McCANNA
DOWMETAL (Magnesium Alloy)
SAND CASTINGS

Let us Research with you

The post war period will find many new uses for Hills-McCanna Dowmetal Magnesium Alloy Sand Castings. Our precision production today is your assurance of tomorrow's dependability. May we discuss the possible application of these Alloys to your needs?

Hills-McCanna Magnesium Alloy Sand Castings are playing an important role in aircraft because they are a part of practically every plane in use by our fighting forces, in the form of Brake and Wheel Assemblies, Carburetor and Engine Parts, Parts for Gun Turrets, Fuselage, Deicing Equipment, Cameras, etc.

Hills-McCanna have the facilities—the experience and the personnel to handle volume production dependably. Rigid control of physical and chemical properties is absolute. That's why Hills-McCanna quality can be depended upon.

HILLS-McCANNA CO.
3015 N. WESTERN AVE. • CHICAGO

PROPORTIONING PUMPS • AIR & WATER VALVES • CHEMICAL VALVES
MARINE VALVES • FORCE-FEED LUBRICATORS • DOWMETAL CASTINGS

Aircraft Subassemblies and Parts

Many of the jobs which Fenn Aircraft is called upon to do involve the manufacture of precision-built parts which are assembled into complete components before shipment. These assembled units are then sent to Airplane Builders as subassemblies ready to be put right on the planes.

The plane or engine builder is saved all the detail and trouble of subcontracting many parts from various sources and assembling them.

Fenn's skill in large-scale, close-tolerance production assures the aircraft manufacturer that these parts and subassemblies are "right" in every detail.

Fenn Aircraft NEW BRITAIN CONNECTICUT

DIVISION OF FENN MANUFACTURING COMPANY

MANUFACTURERS OF AIRCRAFT SUBASSEMBLIES AND PARTS

Fortunately...
it's a "rubber" one

★ It's easy to set up the six important considerations in selecting an aircraft air filter. But measuring the importance to be given each takes a lot of solid thought—and often considerable fortitude in seeing the specifications through.

For, just as a plane design can be slanted toward speed or carrying capacity, air filters can be built to emphasize those qualities most important to each particular plane design.

The position, size and design of the entire air induction system often can be improved by basing them on a particularly designed filter. Many engineers, therefore, find it worth-while to work with competent filter men in the early stages of their designing.

Air-Maze, whose engineers have pioneered the development of aircraft filters since 1926, is eager and able to give you the advantages of its latest developments—its best experience on effective compromise to achieve the filter best fitted to your particular design.

A Few Air-Maze Aircraft Filter Designs

★ These are but a few of the many shapes and sizes in which Air-Maze designs and builds high-velocity, high-efficiency filters. Write for Bulletin 113.

AIR-MAZE CORPORATION • *Engineers and Manufacturers* • **CLEVELAND 5, OHIO**

Representatives in Principal Cities • *In Canada:* Williams & Wilson, Ltd., Montreal, Quebec, Toronto, Windsor

AIR-MAZE

SPECIALISTS IN AIR FILTRATION

Steering Wheel, injection molded of Lumarith E. C. (ethyl-cellulose base) over steel core, a special lightweight plastic, tough at all temperatures, dimensionally stable, chip-proof, and with surface finish which actually improves with use. . . . Like all Lumarith molding materials, Lumarith E. C. is ideal for injection molding.

LUMARITH*

adds a welcome touch

There's an extra dividend of touch-comfort in aircraft control wheels made of Lumarith plastics. They don't steal warmth from the pilot's hands in the sub-stratosphere, or burn them when his craft is sun-baked from standing in the field.

Lumarith plastics are traveling light on American aircraft, in the form of transparent enclosures, snap vents, ventilator tubes, ammunition rollers, handles, Venturi tubes—wherever the extra lightness, toughness and impact strength of Lumarith can help designers reduce weight and add to ceiling and speed.

The technical service division of Celanese Celluloid Corporation has accumulated facts and data of interest to aviation manufacturers and designers. You are invited to make use of this information in both your short and long-range planning. Celanese Celluloid Corporation, *The First Name in Plastics*, a division of Celanese Corporation of America, 180 Madison Avenue, New York City 16. *Representatives:* Dayton, Philadelphia, Cleveland, Chicago, St. Louis, Detroit, Los Angeles, Washington, D. C., Leominster, Montreal, Toronto.

Lumarith* E.C. A Celanese* Plastic

*Reg. U. S. Pat. Off.

CUTTING TOOLS ARE *weapons*

The ability of cutting tools to produce to their maximum is as important on your production line as are weapons of death on the firing line.

Good cutting tools, properly sharpened and ground, should be as efficient throughout their life as they were when originally received from the manufacturer.

Illustrated here are simple instructions for sharpening and salvaging standard Counterbores. No particular trick or wizardry is required. Simply follow directions.

Reprints on request for posting in your Grinding Department

LAND or Primary Clearance—Be sure to maintain the 7-degree clearance angle indicated . . . this relieves and supports the cutting edge. Width of Land should be 1/32" on small, 1/16" on medium and 1/8" on large cutters. When width of Land is increased by sharpening, the Heel or Secondary Clearance should be reground.

HEEL or Secondary Clearance—For accurate and free cutting action, it is important to maintain the Heel or Secondary Clearance at the 29-degree angle indicated. This provides proper chip clearance (eliminates clogging) in the flute—reduces the material to be removed when grinding Land or Primary Clearance.

For best results use a soft, medium grade emery wheel—48 to 60 grain. Free hand grinding is not recommended. When excessive sharpening is necessary, keep the cutter **cool**.

THE GAIRING TOOL COMPANY, Detroit 32, Michigan

gairing TOOLS

Manufacturers of Standard, Special and Gair-Lock Inserted Blade Cutting Tools

The Tasks of Peace . . . The Preparation For the Demands of War

Before the war, King-Seeley Corporation manufactured precision products in large volume for the automotive and allied industries—such items as gauges, speedometers, interval timers, governors and other comparable units.

The knowledge acquired in time of peace is now devoted to the production of war material for our Armed Forces. King-Seeley Corporation is, and has been, for the past two years, supplying a variety of ammunition components and other war items in ever increasing quantities; items of such nature and in such volume that present production schedules are possible only because of the skill and experience acquired in peace time.

That King-Seeley Corporation has succeeded in meeting and continuing to meet its war production demands in both quantity and quality is attested by the Army-Navy "E" pennant awarded in May, 1942, and which now carries three stars.

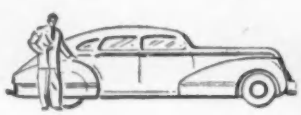
KING-SEELEY CORPORATION
ANN ARBOR MICHIGAN

Illustration from an Inland Poster showing an Inland-made Carbine in the process of assembly

Inland workers know that the hands of America's fighting men across the seas are eagerly reaching for the weapons which they forge. The excellence of the material, and the volume in which it flows, bear powerful witness to the worth of their efforts.

INLAND MANUFACTURING DIVISION
General Motors Corporation, Dayton, Ohio

Inland Products for Victory include Carbines, Tank Tracks, Gun Sights, Helmet Liners, Extinguisher Horns, and rubber and metal parts for tanks, aircraft, submarine chasers, torpedo boats, artillery lighters and landing craft.



INLAND

INLAND *Manufacturing*
RUBBER, METAL, PLASTICS

SELF-LUBRICATING BRONZE BEARINGS at 37 POINTS*...

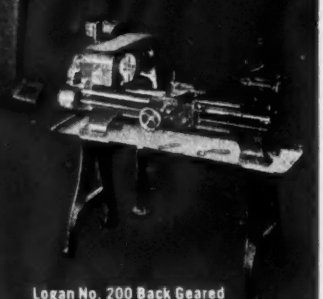
AND PRECISION, PRELOADED BALL BEARING HEADSTOCK

4 BEARINGS IN COUNTER-SHAFT
3 BEARINGS IN REVERSE GEAR BRACKET
11 BEARINGS IN GEAR BOX
6 BEARINGS IN HEADSTOCK
9 BEARINGS IN AUTOMATIC APRON
4 BEARINGS IN CARRIAGE ASSEMBLY

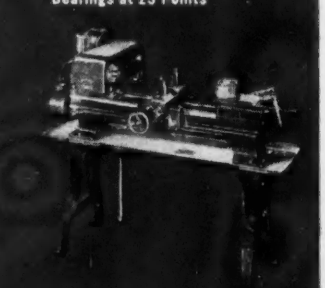
*Arrows indicate location and number of self-lubricating bearings in Logan Quick Change Gear Lathe. All Logan Lathes are similarly protected.

The day you install a Logan Lathe you end your worries about the constant oiling of vital parts. Take, for example, the Logan Quick Change Gear Lathe shown above. At 37 points where plain, oil-thirsty bearings are ordinarily furnished, this lathe gives you *self-lubricating bronze bearings*. Here is a feature of Logan advanced design which automatically eliminates a prime cause of breakdowns. Furthermore, the spindle on this and all Logan Lathes turns on precision, preloaded ball bearings that *never* need lubrication. This Logan combination of self-lubricating bronze bearings with precision, preloaded ball bearing spindle mounting forms another important reason why Logan Lathes are setting remarkable records for sustained accuracy . . . high speed, low cost production . . . longer machine life. Write today for the new catalog that gives you complete information on the advanced design features of all models of Logan Lathes.

Brief Specifications: **. . . Swing over bed, 10½" . . . Between centers, 24" . . . Bed length, 43⅛" . . . Spindle hole, 25/32" . . . Precision ground ways: 2 prismatic V-ways; 2 flat ways . . . 12 spindle speeds, 30 to 1450 r.p.m.**



Logan No. 200 Back Geared Screw Cutting Lathe with Self-Lubricating Bronze Bearings at 23 Points



Logan No. 850 Manufacturing Turret Lathe with Self-Lubricating Bronze Bearings at 19 Points

Logan

A NAME TO REMEMBER WHEN YOU THINK OF LATHES

LOGAN ENGINEERING CO.

Chicago 30, Illinois

One of a series describing the finer features of Logan Lathes . . . Look for the next of the series

A Completely Equipped Foundry has been added to Brake Shoe's Research Group

Vital war work demanded a full-scale foundry for experimental castings.

Such castings might be piloted in a production plant, but this would interfere with regular work.

Today this full-scale experimental foundry is ready for operation as part of Brake Shoe's Research Group.

To house this foundry, an unused factory building had to be dismantled and moved from Kansas City, Kansas, to Mahwah, New Jersey.

If engineers can take new ideas in foundry practice direct to the foundry and get all the kinks out before going into regular production . . .

It should effect important time savings.

It should accelerate necessary field testing and develop improved methods.

In addition to current concentration on problems directly connected with wear, experienced metallurgists and engineers of this Research Group are constantly working to improve products and production methods.

If you have a "punished part" problem, either in the structural or production phase, Brake Shoe's expanded research facilities should be helpful. They are available to manufacturers whose production calls for large runs of standardized parts.

Is Brake Shoe On Your Parts Source List?

Because many of the millions of parts produced by Brake Shoe for war have equally important peacetime uses, Brake Shoe will be ready for parts assignments in volume, the moment victory is won.

American Brake Shoe Company, 230 Park Avenue, New York 17, New York

AMERICAN **Brake Shoe** COMPANY

Brake Shoe's Research Group
1. Engineering Laboratory
2. Metallurgical Laboratory
3. Experimental Foundry

8 DIVISIONS, 59 PLANTS SERVING INDUSTRY AND TRANSPORTATION

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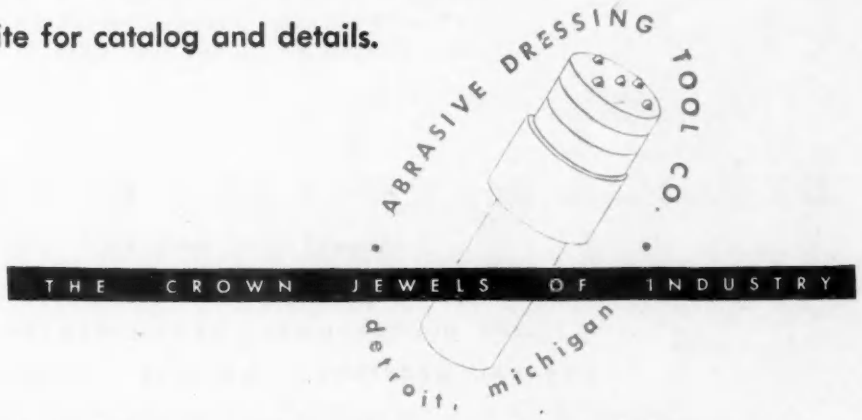
Ramapo Ajax Division . . . . . *New York, N. Y.*	American Forge Division . . . . . *Chicago, Ill.*
American Manganese Steel Division, *Chicago Heights, Ill.*	Southern Wheel Division . . . . . *New York, N. Y.*
Kellogg Division . . . . . *Rochester, N. Y.*	National Bearing Metals Corp. . . . . *St. Louis, Mo.*

Sure, Tony, it's a tough grind... but it's a tougher grind for all the men responsible for grinding-wheel performance. Those men will tell you why they prefer Abrasive RED BAND diamond dressing tools. In addition to three generations of diamond experience, Abrasive alone offers the engineering triumph, the "Oxide-Free Process" which fuses diamonds and powdered metal so miraculously that even the final fraction of each stone wears out in *useful service* . . . providing *better* work, *more* work per set-up. Write for catalog and details.



1822 Makes Sense 1944

• "The history of the wars in Europe furnishes a complete demonstration that no system of conduct, however correct in principle, can protect neutral powers from injury... that a defenseless position and a distinguished love of peace are the surest invitation to war... and that there is no way to avoid it other than by being always prepared and willing, for just cause, to meet it."

• *Message of James Monroe, President, to the Congress of the United States, 1822*

GENERAL MACHINERY CORPORATION

GENERAL MACHINERY CORPORATION

HAMILTON, OHIO

THE NILES TOOL WORKS CO.

THE HOOVEN, OWENS, RENTSCHLER CO.

GENERAL MACHINERY ORDNANCE CORPORATION

One More Shadow on the Rising Sun

TINY though it is, this particular Pratt & Whitney tap landed on Guadalcanal with the Marines . . . and saved American lives! Right under Jap positions this tap cut a new thread that kept a Marine's gun firing . . . and you know what happened. That Pratt & Whitney tap was part of American regular fighting equipment, and it proved as important as bullets. Do you blame us for being proud?

Our men make many thousands of taps at Pratt & Whitney without always knowing where they will be used. All kinds and sizes . . . standard and special . . . go through these skilled hands day and night. Yet each tap receives individual attention, from bar steel to final inspection. Pratt & Whitney taps play a big part in war production . . . our men will not knowingly pass any but the best. They know that many of them, like this tap from Guadalcanal, are in the hands of American fighters in every corner of the world . . . chosen because of outstanding Pratt & Whitney quality and performance. We will not violate that trust.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT

- No Fire Hazard
- Lower Fuel Consumption
- Increased Striking Range
- Greater Stamina
- Dependable Operation
- Instant Response to the Throttle
- No Ignition System
- Lower Cost of Fuel
- Constant Torque at All Speeds
- No Radio Interference

America's Radial Air-cooled Diesel Engine

Guiberson's present world leadership in the field of radial diesel engineering began more than fourteen years ago when Guiberson engineers developed the world's only high-speed air-cooled radial diesel engine. Eleven years ago the first Guiberson-powered plane took to the air and the first A.T.C. certificate for the Guiberson radial diesel engine was granted. Eight years ago the first Guiberson radial diesel took its place in the tanks of our first armored force. Today the Guiberson radial diesel engine provides dependable, low-cost, fire-safe power that will help America win the edge that is needed for victory—and it is the power plant that will win leadership for America in the field of post-war transportation on land, on sea, and in the air!

Established 1919

BETTER BE SAFE THAN SORRY — GUIBERSON

Guiberson U. S. A.

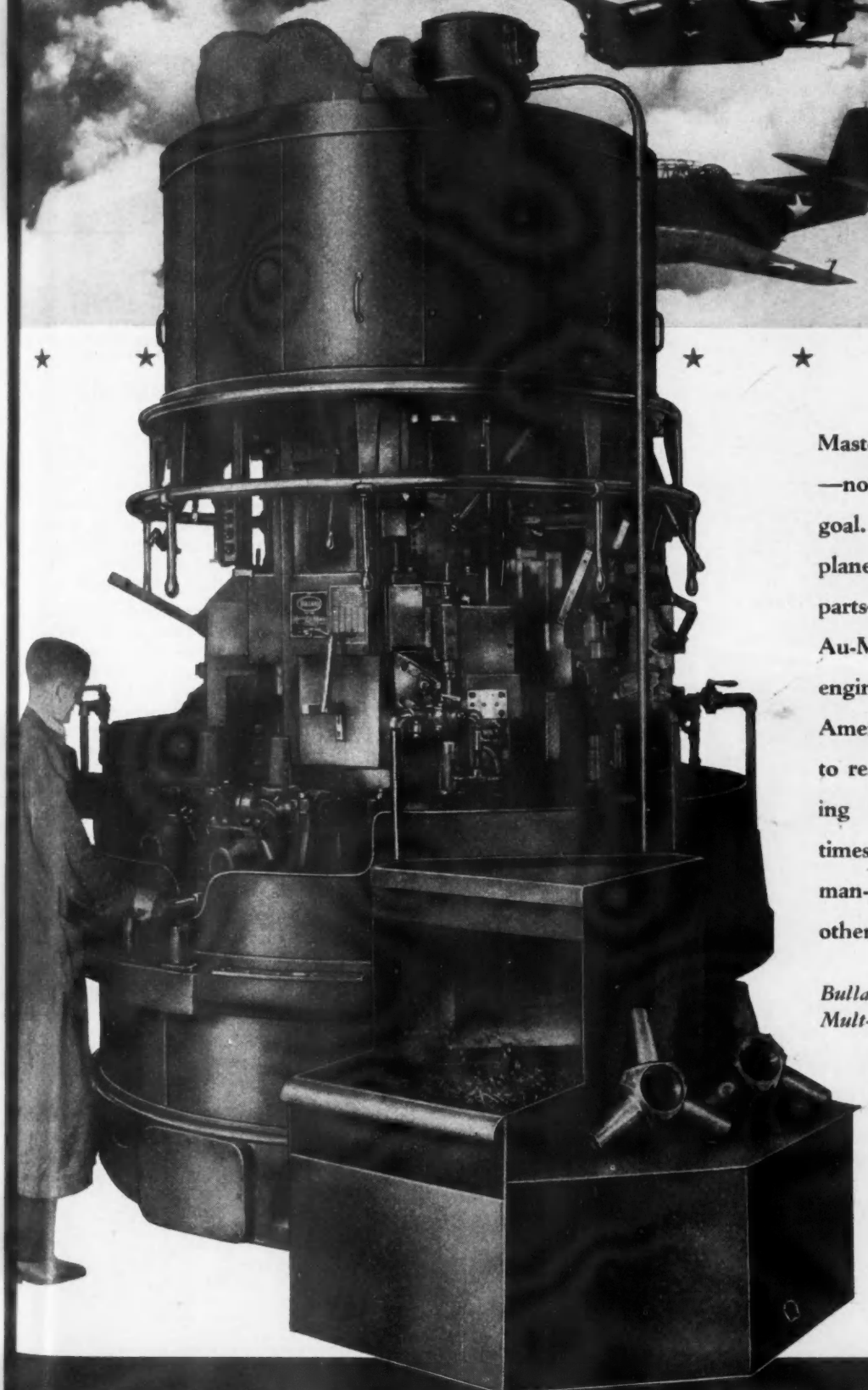
GUIBERSON DIESEL ENGINE COMPANY
Dallas, Texas

THE GUIBERSON CORPORATION
Aircraft and Heater Division

What These May Fly...

U. S. Navy Official Photo

★ ★ ★ ★ ★ ★ ★ ★

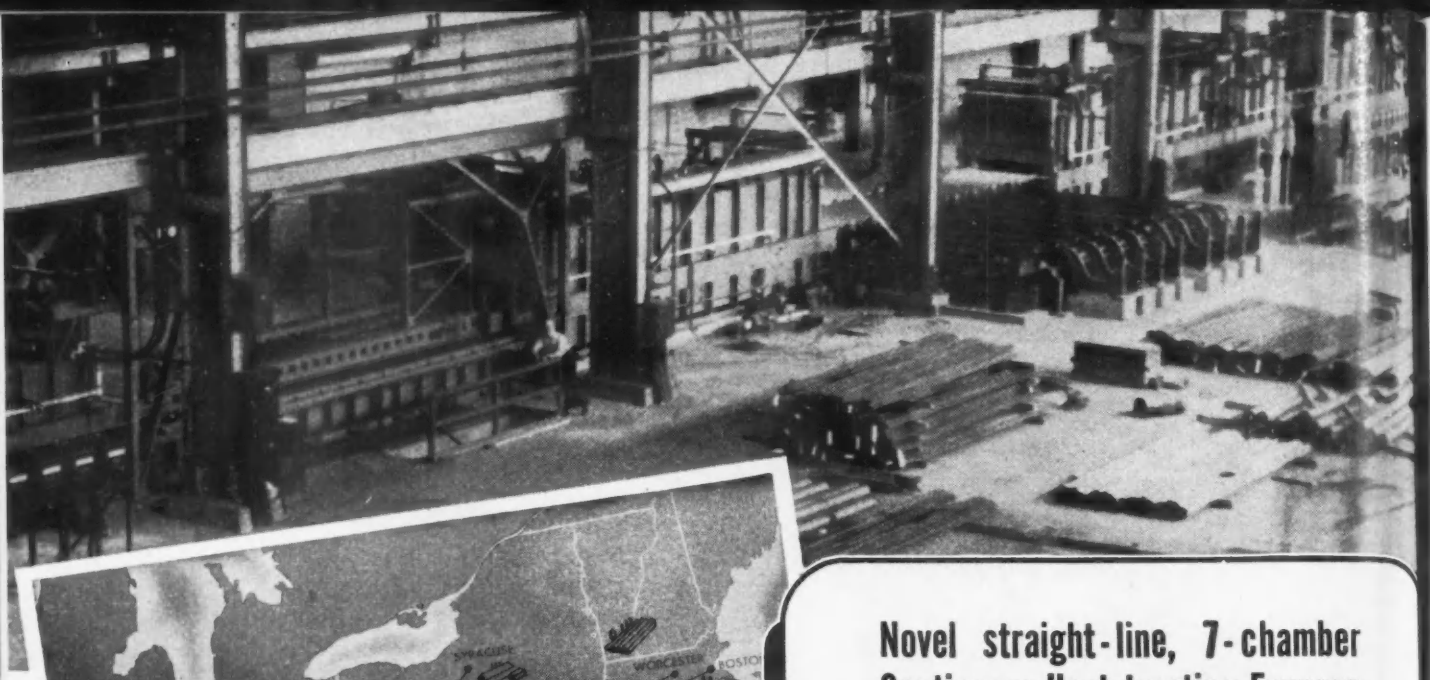


Mastery of the air on all fronts —nothing less can be America's goal. That requires ever more planes and more replacement parts—on time. Bullard Mult-Au-Matics at work on parts for engines of every important American plane are doing much to realize that goal . . . by striking reductions of production times, by constantly freeing man-power and floor space for other work.

Bullard 16"-8 Spindle Type "D" Mult-Au-Matic machining propeller hub spider. This shows the third chucking, with 3 changes of position. The Mult-Au-Matic time for 3 positions is 18 min. 5 sec. as compared to the former production time of 5¼ hours per piece.

THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT



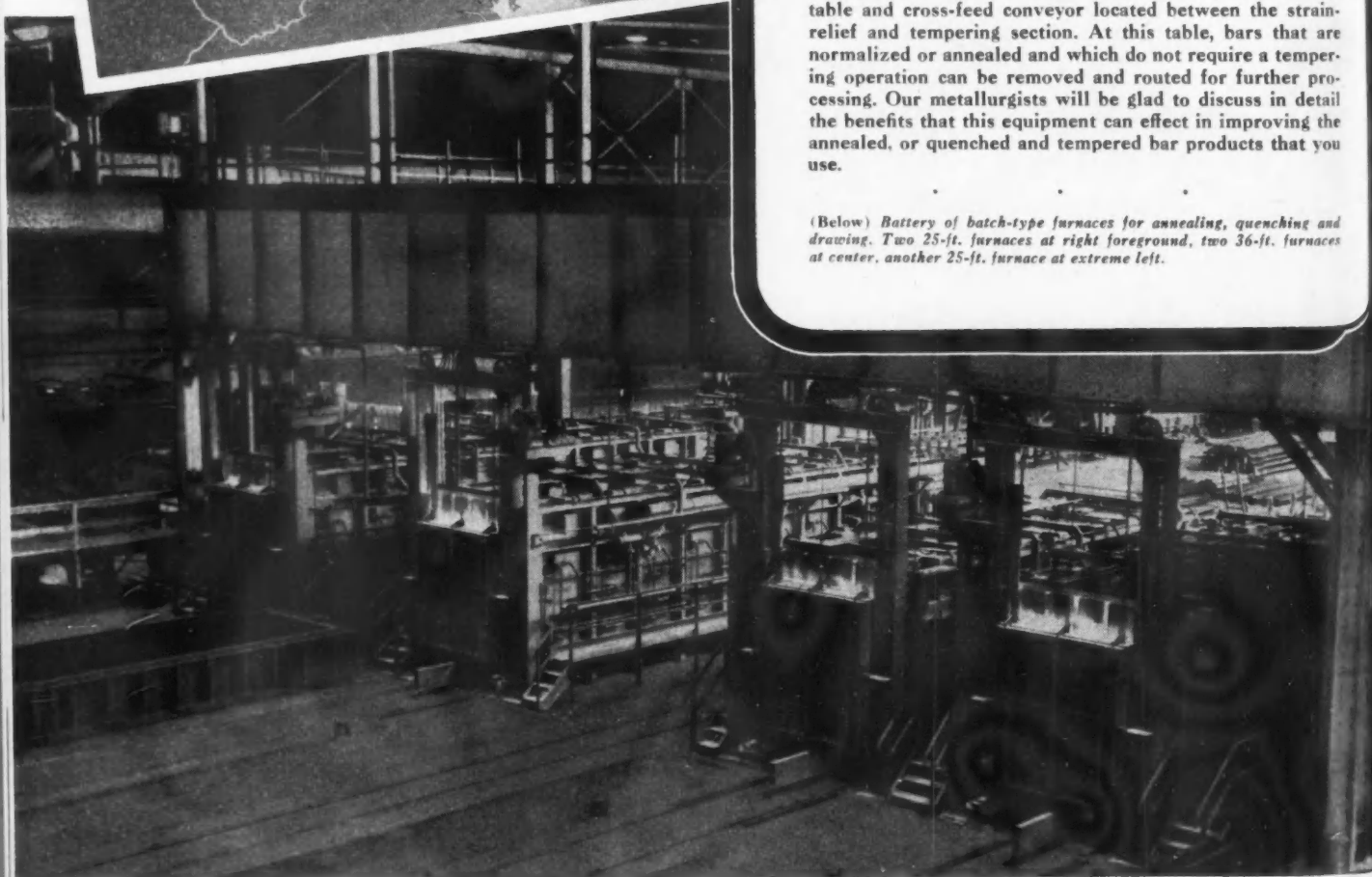
Novel straight-line, 7-chamber Continuous Heat-treating Furnace assures high and uniform quality

In sequence of operation, the line consists of (1) a heating section divided into preheating, intermediate, and high temperature chambers, each with separate doors; (2) a quenching tank for either oil or water quenching under automatic cycle control; (3) a strain-relief furnace; (4) center discharge and cross-feed transfer table, and (5) a tempering section. This last section, like the heating section, is also divided into three chambers, each with separate doors.

Extreme flexibility is obtained in the unit by the discharge table and cross-feed conveyor located between the strain-relief and tempering section. At this table, bars that are normalized or annealed and which do not require a tempering operation can be removed and routed for further processing. Our metallurgists will be glad to discuss in detail the benefits that this equipment can effect in improving the annealed, or quenched and tempered bar products that you use.

. . .

(Below) *Battery of batch-type furnaces for annealing, quenching and drawing. Two 25-ft. furnaces at right foreground, two 36-ft. furnaces at center, another 25-ft. furnace at extreme left.*



UNITED STATES STEEL

To better serve steel users in the East.....

New and special heat-treating equipment now available at Pittsburgh...*has capacity to handle 25,000 tons of rolled alloy steel products annually*

THIS NEW HEAT-TREATING equipment places at the disposal of alloy steel users in the Eastern area the latest and most advanced mechanical and metallurgical developments in the fine art of annealing and heat treatment. It supplements the 158,400-ton annual capacity for producing electric furnace steel now in operation at our Duquesne Works, near Pittsburgh.

High, uniform quality is insured by a novel, 7-chamber, continuous furnace electrically heated and automatically controlled. It is used for production line service in heat treating bars which require quenching and drawing operations, normalizing or annealing, including special types of anneals such as sub-critical or by isothermal transformation.

So arranged that it may be operated in a continuous 366-ft. hardening and tempering line, this furnace will handle a *single layer* of 25-ft. bars, from ⅜ in. to 8¼ in. diameter, as well as flats or squares.

This method of single layer heat treatment of bars has definite advantages. Bars will be more uniformly heated, less scale is formed, overheating is avoided. Greater flexibility and closer control are also assured whenever a particular or special type of heat treatment is necessary.

For spheroidize annealing and for annealing operations requiring long controlled, slow-cooling cycles, three 25-ft. and two 36-ft. gas-fired car bottom furnaces are further available. Oil and water quench tanks are available for heat treating bars from these furnaces. The necessary auxiliary equipment is of the latest, most improved type.

Designed to insure superior physical properties in the heat-treated product, this equipment provides the flexibility to handle small orders as well as full heats when necessary.

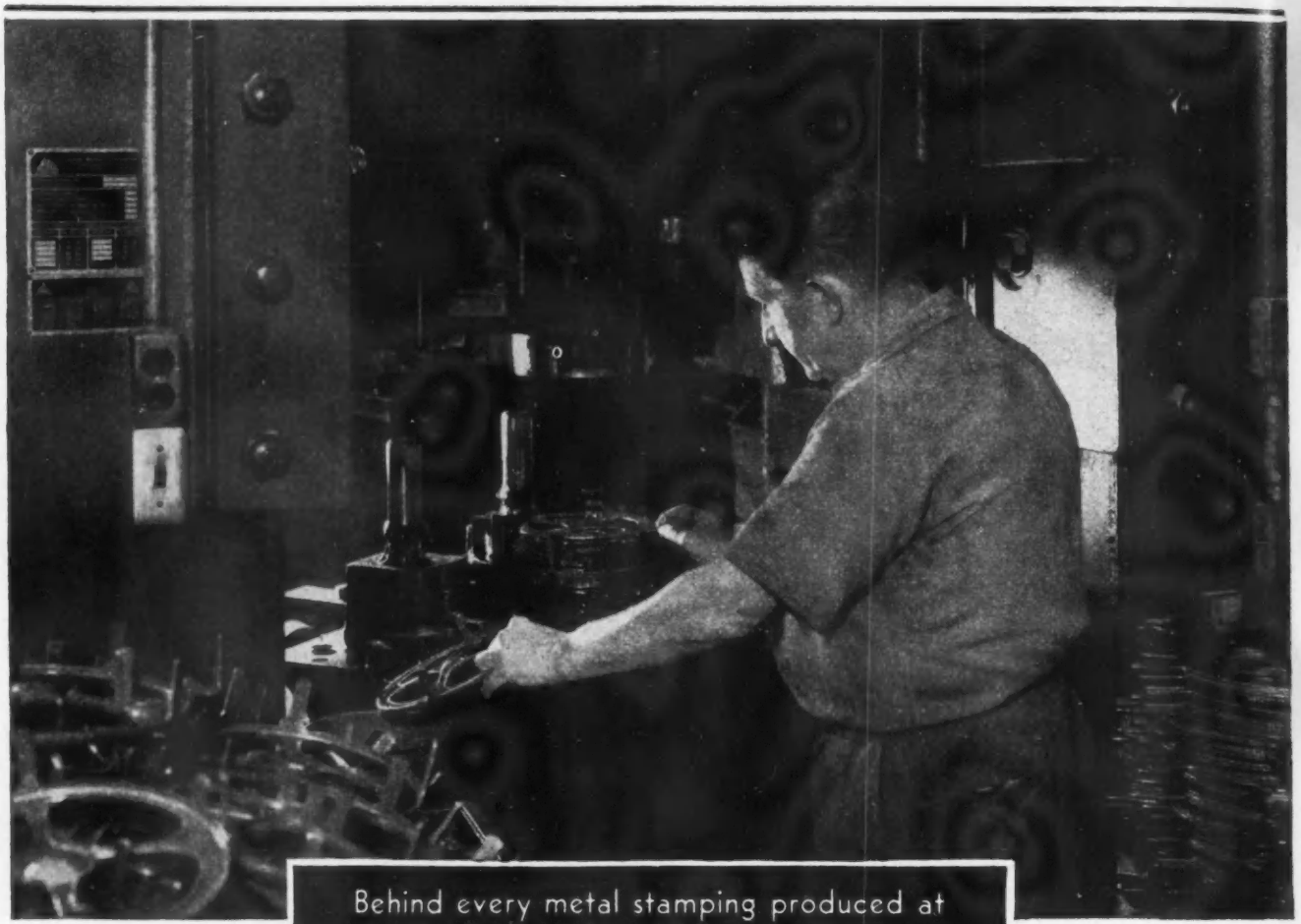
USS

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

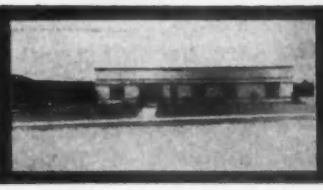
PRECISION STAMPING



Behind every metal stamping produced at the Plants of the Metal Specialty Company is a background of years of experience. This experience combined with an Engineering and Designing Staff of the highest calibre assures you not only the finest in Metal Stamping, but an efficient and authoritative Service for your specific problems. Metal Specialty serves Industry in Stamping, Coining, Forming, Drawing, Annealing and all types of Welding. Specialists in Hydraulic Cold Drawing and Embossing on all metals, including Stainless Steel and Aluminum. Deep Drawing and Embossing up to 850 tons capacity. Shells drawn up to 20" depth.

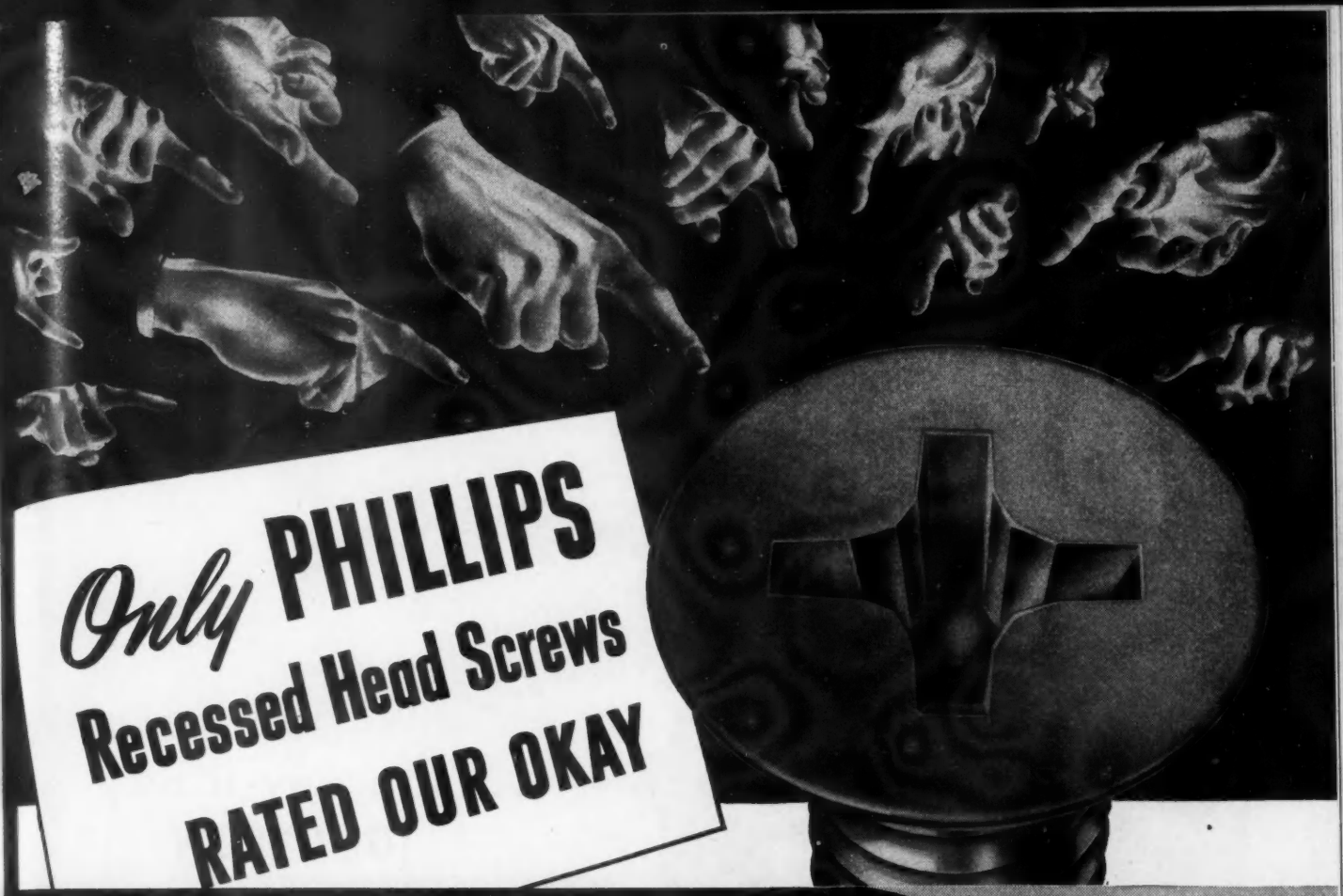
Address inquiries on Plastic Molding to The Metal Specialty Co., Plastic Division, Cincinnati, Ohio.

Branch Plant and Sales Office — Richmond, Indiana. Sales Office—Detroit, Michigan.



The
METAL SPECIALTY *Co.*

MAIN OFFICE AND PLANT • ESTE AVENUE • CINCINNATI, OHIO



Only PHILLIPS Recessed Head Screws RATED OUR OKAY

...say 23 Leading Screw Manufacturers

FOR YEARS, leading screw makers tested ideas for recessed heads. All showed design faults. Then came the Phillips Recess. Unanimously, these makers agreed that here, at last, was the answer they'd been looking for . . . a scientifically engineered recess, *right* in every respect.

And practically the entire screw industry adopted it!

There's nothing exactly like the Phillips Recess. It's the only screw recess in which every angle, every dimension has a purpose—plays a definite part in screw driving efficiency and fastening strength.

That's why it pays to specify screws with Phillips Recessed Heads. You can get them in any head style, type, or size.

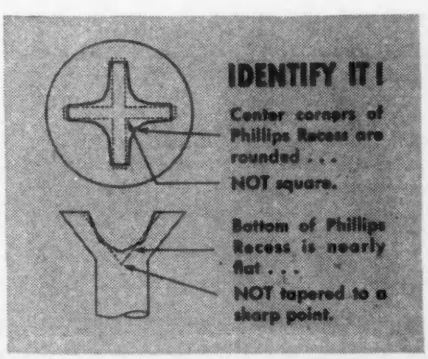
TO MAKE WARTIME QUOTAS AND PEACETIME PROFITS

FASTER STARTING: Driver point automatically centers in the Phillips Recess . . . fits snugly. Fumbling, wobbly starts, slant driving are eliminated. Work is made trouble-proof for green hands.

FASTER DRIVING: Spiral and power driving are made practical. Driver won't slip from recess to spoil material or injure worker. (Average time saving is 50%.)

EASIER DRIVING: Turning power is fully utilized. Workers maintain speed without tiring.

BETTER FASTENING: Screws are set-up uniformly tight, without burring or breaking of screw heads. The job is stronger, and the ornamental recess adds to appearance.


IDENTIFY IT!
Center corners of Phillips Recess are rounded . . .
NOT square.
Bottom of Phillips Recess is nearly flat . . .
NOT tapered to a sharp point.

AMERICAN SCREW CO.
Providence, Rhode Island
THE BRISTOL CO.
Waterbury, Connecticut
CENTRAL SCREW CO.
Chicago, Illinois
CHANDLER PRODUCTS CORP.
Cleveland, Ohio
CONTINENTAL SCREW CO.
New Bedford, Massachusetts
THE CORBIN SCREW CORP.
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Nashua, New Hampshire

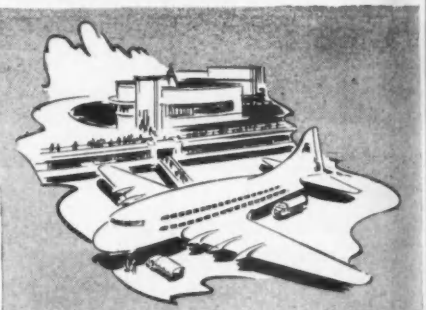
PHILLIPS *Recessed Head* SCREWS

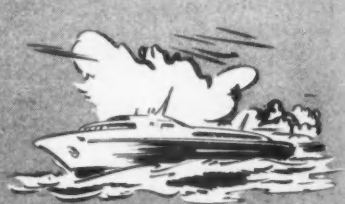
WOOD SCREWS
MACHINE SCREWS
SELF-TAPPING SCREWS
STOVE BOLTS

Increasing . . . the military-load TODAY

7½ K.W.
116 LBS.

. . . the pay-load TOMORROW





ANDOVER Auxiliary Power Units are increasing the military load of our bombers today. Every *ounce* cut from dead plane-weight means extended bombing range, larger ammunition load and greater safety for the crew. *One* 116-lb. Andover Auxiliary Power Unit Saves *100 lbs.* weight by replacing three 72-lb. batteries...and provides constant, never-failing electric power on demand. And tomorrow . . . this compact, light-weight unit will increase the pay load of many industries wherever portable electric power is needed.

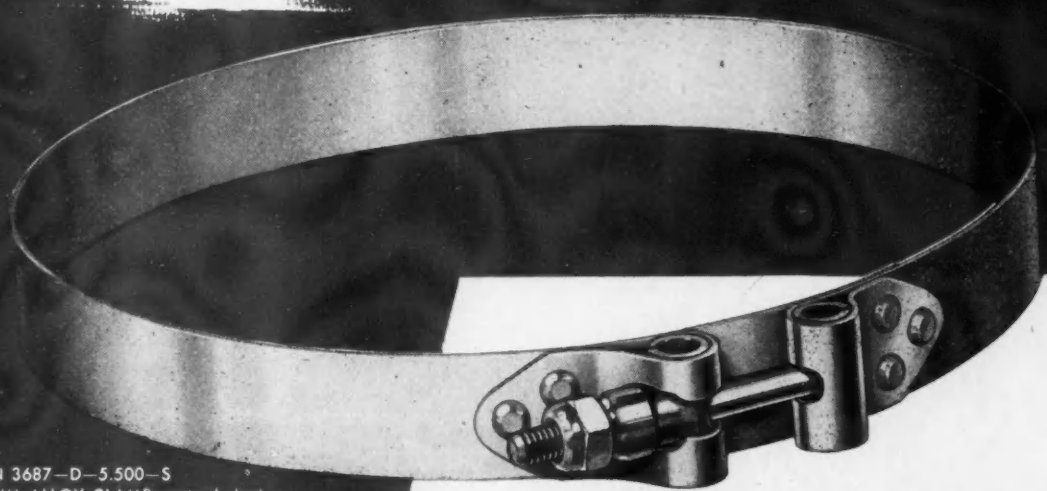
Engine alone weighs 81 lbs. 15 oz. *The complete Andover Auxiliary Power Plant consists of a two-cylinder air-cooled 10 H. P. engine driving a 28.5-volt generator supplying a continuous power output of 5 K. W. with a peak load of 7½ K. W. Its complete weight with generator and adapter is only 116 lbs.*

Andover AUXILIARY POWER

ANDOVER MOTORS CORPORATION • ELMIRA, N. Y.

WHOLLY-OWNED SUBSIDIARY OF ANDOVER KENT AVIATION CORPORATION

Now! AN ALUMINUM ALLOY CLAMP THAT COMBINES HIGH STRENGTH WITH LIGHT WEIGHT



*MARMAN 3687—D—5.500—S
ALUMINUM ALLOY CLAMP—actual size!

CHARACTERISTICS OF ALL MARMAN CLAMPS

CIRCUMFERENTIAL LOADING

Tension is uniform around any convex surface. No bulging, pinching or distortions.

QUICKLY INSTALLED

QUICKLY REMOVED

Marman Clamps may be opened and wrapped around any connection. May be installed and removed repeatedly without efficiency loss.

A SIZE AND SHAPE FOR EVERY JOB

Circular, oval, square, oblong and irregular shapes are all easily handled with Marman Clamps.

MARMAN clamps

Marman Aluminum Alloy Clamps save weight . . . in many instances more than 50% compared with steel clamps of equivalent strength. The patented Marman design requires no severe forming, and clamping action develops no stress concentrations anywhere in the clamp assembly. These clamps are particularly suited for Aircraft ventilation, carburetor intake, supercharger, intercooler and similar installations where medium or large sizes are required.

COMPARISON DATA!

*Type: D(61-ST)	Type: C. R. (AN-S-11)
Size: 5½" I. D.	Size: 5½" I. D.
Width: .6875"	Width: .6875"
Band Thickness: .032"	Band Thickness: .031"
Weight: 1 oz.	Weight: 2⅓ oz.
Min. Yld.: 600 lbs.	Min. Yield: 600 lbs.

MARMAN PRODUCTS CO. Inc.

940 WEST REDONDO BOULEVARD
INGLEWOOD, CALIFORNIA

THE LARGER THE CLAMP THE GREATER THE WEIGHT SAVING!

YOU SET THE STANDARDS

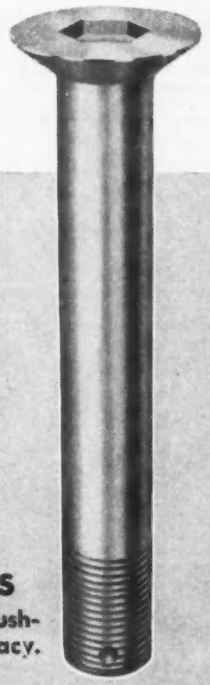
WE MATCHED THEM WITH

UNBRAKO

Reg. U. S. Pat. Off.

INTERNAL WRENCHING SOCKET BOLTS

Designed expressly for the aviation industry, "Unbrako" Internal Wrenching Socket Bolts are made to extremely close tolerances. Their manufacture is handled exclusively by our largest and best equipped department, where only highly skilled workers with long training and experience in making precision aircraft engine parts are employed. Every step in the manufacturing process is rigidly controlled and close inspections maintain the high degree of precision demanded. Quality is assured by the "Unbrako" name and reputation. The internal wrenching feature facilitates compact designs,—effects considerable savings in weight, material and cost.



100° FLUSH-HEAD SOCKET BOLTS

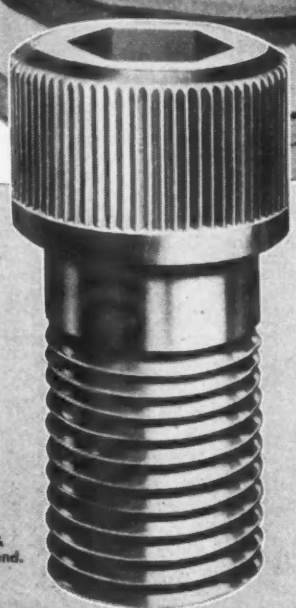
Unlike ordinary flush-heads, "Unbrako" 100° Flush-Head Socket Bolts are made to most extreme accuracy.

OVER 40 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 611

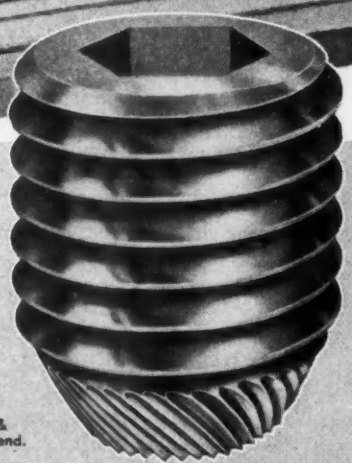
BRANCHES: BOSTON • DETROIT • INDIANAPOLIS • CHICAGO • ST. LOUIS • SAN FRANCISCO



Pat'd. & Pats. Pend.

KNURLED SOCKET HEAD CAP SCREWS

The use of "Unbrako" Socket Cap Screws with the Knurled Heads eliminates time-wasting finger slip and lost motion, and the pace of assembly can therefore be considerably stepped up. Knurling also permits locking of "Unbrako" Socket Caps. Sizes: No. 4 to 1½" diameter.



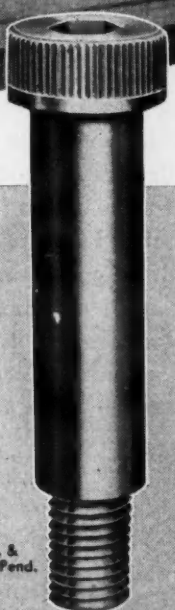
Pat'd. & Pats. Pend.

SELF-LOCKING HOLLOW SET SCREWS

When tightened as usual, the knurled points of "Unbrako" Hollow Set Self-Lockers dig in and lock automatically, positively prevent loosening by vibration. Their application therefore effectively reduces maintenance costs and worries. Sizes: No. 4 to 1½" diameter.

Knurling of Socket Screws originated with "Unbrako" years ago.

OVER 40 YEARS IN BUSINESS

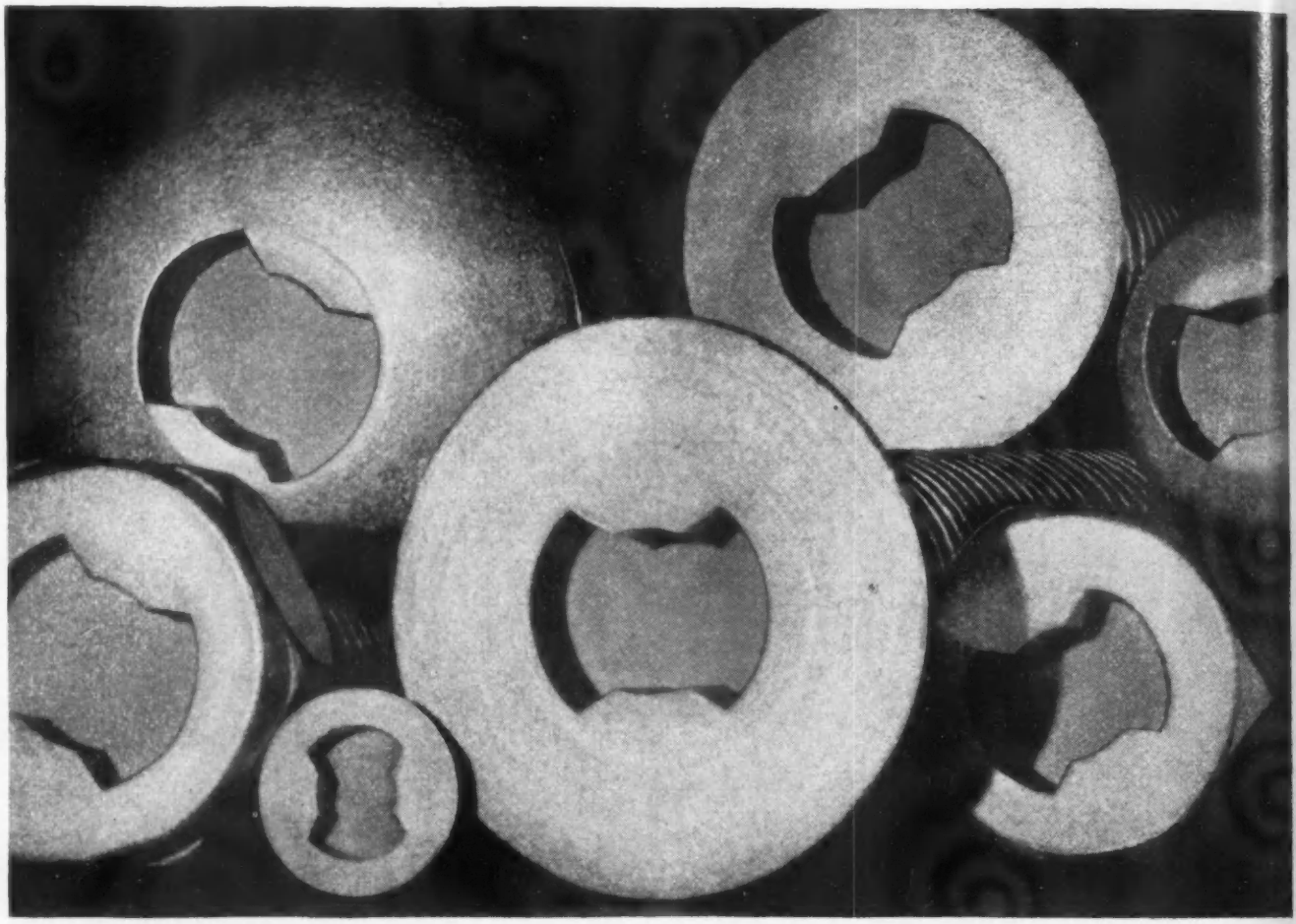


Pat'd. & Pats. Pend.

KNURLED SOCKET HEAD SHOULDER SCREWS

Precision ground, Knurled "Unbrako" Socket Head Shoulder Screws have effective and widespread application throughout the entire industry. Great variety of sizes immediately available from stock.

STANDARD PRESSED STEEL CO.



They "Cancel-Out" a lot of Handicaps

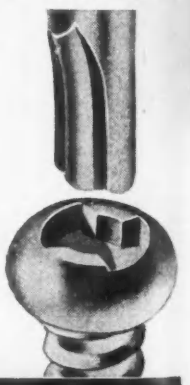
The phrase isn't ours. It comes from the assembly lines . . . where new factors for speed, safety, simplicity, and lower cost are rated high. CLUTCH HEAD Screws "cancel-out" the handicap of slow-down hesitation. The wide roomy clutch offers an easy bull's-eye target for the "greenest" operator, inviting speed born of confidence . . . the automatic entry of the Center Pivot Driver into dead center of the recess speeds and eases the drive home . . . and that same definite torque grip assures the operator there is no hazard of slippage. Then there is the CLUTCH HEAD Lock-On feature which nullifies the handicap of fumbling around hard-to-get-at spots by uniting screw and bit as a unit for easy one-handed reaching. In field maintenance, too, CLUTCH HEAD simplifies operations by solving hitherto accepted problems. Service men prefer this modern screw because it may be operated with the ordinary type screwdriver . . . even with a piece of flattened steel rod in an emergency. They know also that, where screws have to be removed, saved, and used again, the CLUTCH HEAD Lock-On feature obtainable with the Center Pivot Hand Driver "cancels-out" the serious handicap of dropped and lost screws.

Get personally acquainted with these many exclusive features. Send for assortment of CLUTCH HEAD *Screws, sample Center Pivot Bit, and fully illustrated Brochure.*

CLUTCH HEAD Screws are contributing importantly to many phases of the war effort. They are available in Standard and Thread-forming types for every purpose . . . production backed by the extensive resources of this Corporation and by responsible Licensees.

CLUTCH HEAD · SCREWS ·

ECONOMY is an important feature of this Center Pivot Assembler's Bit. No "back-to-the-factory" shipment is necessary for reconditioning. A brief application of the end surface to a grinding wheel fully restores original efficiency.



UNITED SCREW AND BOLT CORPORATION

CHICAGO CLEVELAND NEW YORK

Compact in design—sturdily constructed—foolproof in operation—this powerful DeWalt will *speed up* your cut-off operations not only in today's emergency but long after the war is over. Write for descriptive literature.

DE WALT
PRODUCTS CORPORATION
LANCASTER, PA.

Obsolescence

Stuffed owls cannot fly, nor can obsolescent machinery be used in profitable production. *New competition* in the form of new markets, new products, new low prices, new materials, new methods, new companies and new equipment will force revolutionized production lineups. You'll be wise if you check over your situation now! Be ready to meet this multiple competition!

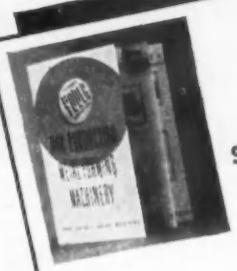
Most production lines will be modernized by a revamping of existing facilities. Perhaps it will be the addition of a Yoder Roll Forming Machine and Automatic Cutoff, A Tube Mill Line or some special metal working machine. The forward thinking of Yoder Engineers and the advanced design of their machines can help you to meet the new competition.

For over thirty years, Yoder customers have been saying, "You get the improvements first from Yoder."

A bulletin on our line of metal working machinery is available. In special cases, send rough sketches, notes and blueprints — we'll be glad to submit suggestions and cost estimates.

THE YODER COMPANY • 5500 Walworth Ave., Cleveland 2, Ohio, U.S.A.

COMPLETE TUBE MILL LINES • ROLL FORMING MACHINES AND AUXILIARY EQUIPMENT • SPECIAL METAL WORKING MACHINERY



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STATE_____

ENGINEERING
YODER
MANUFACTURING

First of a series of articles on the preparation of metal surfaces for protective finishes

PICKLE BATH TONERS

IMPROVED PICKLE SOLUTIONS PRODUCE BRIGHTER AND CLEANER WORK

Research Chemists in the American Chemical Paint Company laboratories, some years ago, made a valuable contribution to metal finishing which revolutionized the acid pickling of iron and iron alloys. The inhibitor—Rodine—which was developed at that time controls the pickling action to the removal of scale and prevents needless attack on clean metal. In addition to making it possible to greatly increase the speed of production, the savings in acid, metal, and the reduction of hydrogen embrittlement makes the use of Rodine standard in most pickling operations today.

In the continuing research on the pickling of metals, the ACP Laboratories have developed a further aid for pickling baths—"ACP Pickle Bath Toner" for use with or without Rodine. It fills a definite place in improving the finish of pickled metals and greatly reduces waste due to excessive dragout.

ACP Pickle Bath Toners are supplied in either a powder or liquid form for use in either sulphuric or muriatic acid solutions, producing brighter and cleaner surfaces. The emulsifying action of Pickle Bath Toners reduces the contamination of the pickle solution by oil, admirably adapting them to the pickling of work slightly oily and in conjunction with Rodine for the pickling of alloy steels that are difficult to pickle.

These Pickle Bath Toners, in both the powder and liquid grades, are furnished with and without inhibitor action. The uninhibited types are recommended where the advantages of the Pickle Bath Toner can be combined with the many advantages of the inhibitor, Rodine. In such cases the Toner *and* the Rodine are added to the new pickle bath and as future additions of acid are made only the Rodine is added.

In a few operations where strong inhibitor action is not required, for example in cold pickling solutions, or where actual attack or "etching" of the metal is wanted for subsequent operations, the use of the mildly inhibited form of Toner is recommended to obtain the improved cleaning action and still retain sufficient inhibition to prevent excessive etching.

Any sulphuric or muriatic pickle solution will be improved by the addition of ACP Pickle Bath Toner. Generally the powdered forms are recommended for use in sulphuric acid and the liquid forms for use in muriatic acid solutions. ACP Pickle Bath Toners are now supplied as follows:

Pickle Bath Toner No. 101—Powdered form without inhibitor for use with or without Rodine.

Pickle Bath Toner No. 102—Mildly inhibited powdered form for use without Rodine where but little inhibitor action is wanted.

Pickle Bath Toner No. 1—Non-inhibited liquid form for use with or without Rodine.

Pickle Bath Toner No. 2—Inhibited liquid form for use without Rodine where but little inhibitor action is wanted.

While ACP Pickle Bath Toners will be generally beneficial there are several operations where little inhibitor action is deemed necessary, including electroplating, galvanizing, pickling in cold solutions or in some electrolytic pickling units, etc. In addition, Pickle Bath Toners also improve the penetration, the wetting and the spreading action of zinc or ammonium chloride fluxes in preparation for galvanizing, tinning, etc.

Rodine
Makes Pickling Efficient
This steel surface photograph (magnified) was pickled in an uninhibited acid bath. Note the deep pits, and that the surface is visibly crystalline.
This surface pictured was pickled exactly like the other except that RODINE was added to the acid solution. Only scale pockets and roll marks are visible; no pitting occurred.

Steel requires pickling to remove scale whether the fabrication is for steel plates for battleships, airplane parts, motor vehicle or ordnance parts.

Rodine in the pickling bath confines the acid action to removing the scale and inhibits acid action on the clean metal. This controlling action of Rodine in preventing the acid from dissolving clean steel, saves acid by eliminating a needless waste. The life of the pickle bath is increased and better pickling is accomplished.

Our technicians are available to adapt Rodine or other ACP Products to your individual production problems. Time will be saved if you will give us as complete details as possible concerning your methods and requirements.

Manufacturers of Inhibitors & Metal Working Chemicals

AMERICAN CHEMICAL PAINT CO.
AMBLER ACP PENNA.

Note—West Coast Plants may address inquiries and orders for prompt delivery to Leon Finch, Ltd., 728 East 59th St., Los Angeles, California.

AMERICAN CHEMICAL PAINT COMPANY, AMBLER, PA.

Please send me general Technical Service Data Sheets on

Name_____ Title_____ ☐ *Rodine*

Company_____ ☐ *Pickle Bath Toner* K-2

Address_____

MUNITIONS

...for Peace

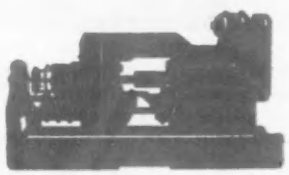
Today's first job is to win the war. Everybody agrees on that, but there is nothing unpatriotic about planning for what is going to happen when the shooting stops.

The ability to produce that is overpowering the enemy with the tools of fighting can begin to make automobiles and refrigerators and radios at remarkable speed — and prevent a long period of unemployment — if we have the plans ready to go on V-day.

Remember that your Acme-Gridley Bar and Chucking Automatics are *adaptable machines*. They turn out identical metal parts, *for all purposes*, quickly and cheaply, maintaining whatever precision standards your work demands.

To help you reconvert quickly, National Acme offers the services of the men who actually built and tooled your Acme-Gridleys.

Whenever this service fits into your plans, feel free to ask us to send one of these experienced men into your plant to speed up the retooling job.



ACME-GRIDLEY AUTOMATICS
maintain accuracy at the highest spindle speeds and fastest feeds modern cutting tools can withstand.

The NATIONAL ACME *Company*

CLEVELAND · OHIO

Speed the Attack

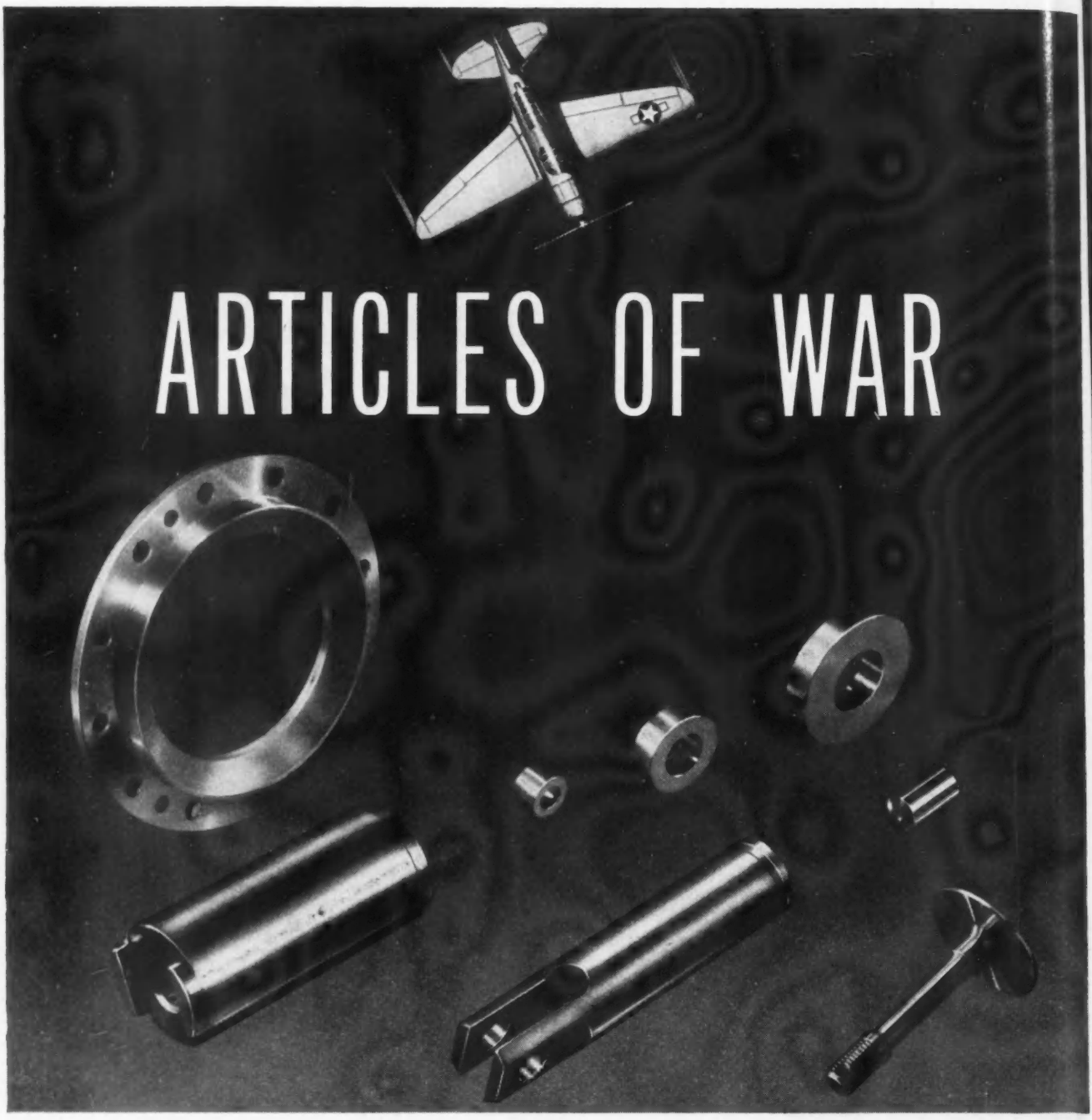
WITH ARO PNEUMATIC TOOLS

● Help your production lines send more "greetings" like this to Tojo and Hitler—by speeding up small tool jobs with ARO Pneumatic Tools!

ARO Engineering has packed tremendous power into these surprisingly small units. ARO Tools step up efficiency, cut down fatigue...for drilling, nut-setting, screw-driving, grinding, and countless other jobs. Simple in design...rugged...dependable...stall-proof. Ideal for women! Ask ARO Field Engineers to help solve your problems requiring special or standard tools. Write for new catalog. The Aro Equipment Corporation, Bryan, Ohio.

This full ¼-inch capacity drill Model 101 with plastic housing and handle weighs only 1 lb. 9 oz.—one of the newest additions to the ARO line.

THE ARO EQUIP. CORP. PNEUMATIC ARO TOOLS BRYAN, OHIO



Here are articles of war—just a few of the hundreds of thousands of similar "articles" which combine to create the offensive weight of our mechanized armies.

These pieces of equipment are hardened and ground aircraft engine parts. Their effectiveness lies in their absolute precision. Their most important ingredient is skill. For these qualities there are no substitutes.

We are glad that the skills and specialized equipment of Allied Products Corporation, perfected during many years of peacetime production, have been equal to the task of producing these and other parts in quantity.

"IT'S AN ALLIED PRODUCT!" . . . Allied Products Corporation and its divisions, Richard Brothers and Victor-Peninsular, in Detroit and Hillsdale, Michigan, also make: The original, patented R-B interchangeable punch and die; sheet metal dies; plastic molds; jigs and fixtures; cold forged parts; and other special products.

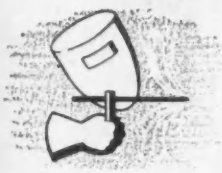
BUY MORE WAR BONDS

ALLIED PRODUCTS CORPORATION

Executive Office
4646 Lawton Avenue
Detroit 8, Michigan

ALL FOUR PLANTS HAVE NOW ADDED THE STAR TO THEIR ARMY-NAVY "E" PENNANTS

PAGE *Welding* ELECTRODES



PAGE COATING HELPS YOU ON YOUR STAINLESS WELDING

Certainly it is important to you that **PAGE** developed a range of electrodes for welding stainless steel that is complete.

But don't overlook the important value to you of the **PAGE** coating on these electrodes—sufficiently heavy to provide the shield necessary to prevent oxidation; to provide the protection of easily removed slag that permits more cooling time; that eliminates surface checking, and that holds spatter loss to a minimum.

PAGE ALLEGHENY STAINLESS STEEL ELECTRODES provide the metal you want, help you get it where you want it and protect the job your men do. Ask your local **PAGE** Distributor.

PAGE STEEL AND WIRE DIVISION

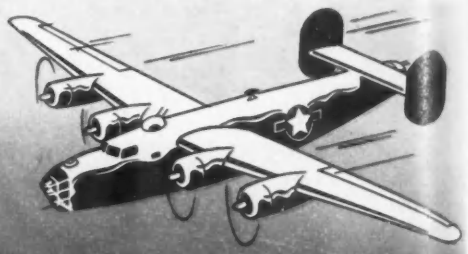
Monessen, Pa., Atlanta, Chicago, Denver, Los Angeles, New York, Pittsburgh, Portland, San Francisco

AMERICAN CHAIN & CABLE COMPANY, Inc.

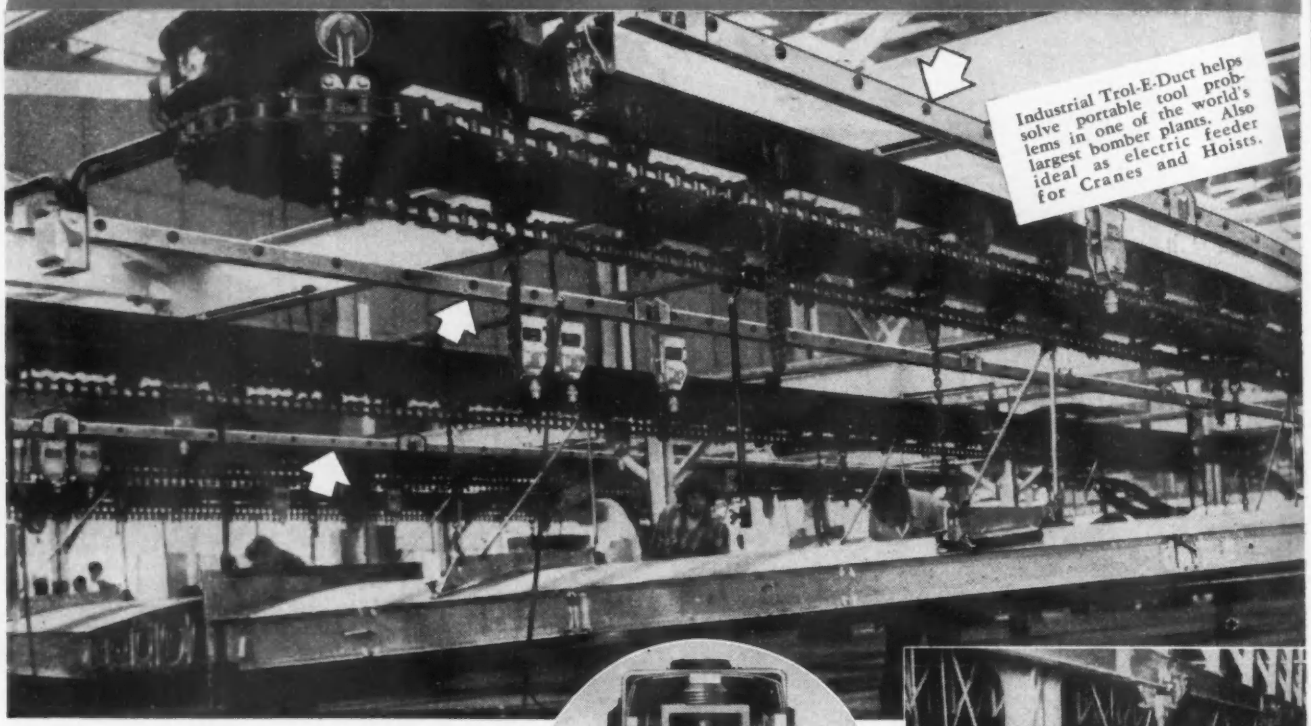
BRIDGEPORT • CONNECTICUT

ESSENTIAL PRODUCTS . . . TRU-LAY Aircraft, Automotive, and Industrial Controls, TRU-LOC Aircraft Terminals, AMERICAN CABLE Wire Rope, TRU-STOP Brakes, AMERICAN Chain, WEED Tire Chains, ACCO Malleable Castings, CAMPBELL Cutting Machines, FORD Hoists, Trolleys, HAZARD Wire Rope, Yacht Rigging, MANLEY Auto Service Equipment, OWEN Springs, PAGE Fence, Shaped Wire, Welding Wire, READING-PRATT & CADY Valves, READING Electric Steel Castings, WRIGHT Hoists, Cranes, Presses . . . *In Business for Your Safety*

POWER FOLLOWS THE JOB



IN GREAT U. S. AIRCRAFT PLANTS



Industrial Trol-E-Duct helps solve portable tool problems in one of the world's largest bomber plants. Also ideal as electric feeder for Cranes and Hoists.

INDUSTRIAL TROL-E-DUCT BRINGS POWER CLOSE TO THE TOOL

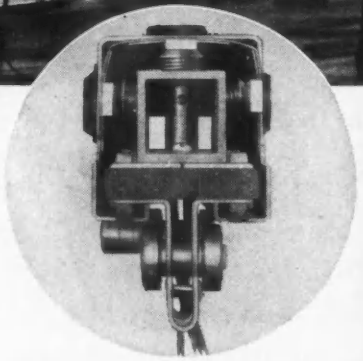
In these days of fast-moving production lines and frequent changeovers, war plants must have a *movable* source of power for portable tools.

Only Industrial Trol-E-Duct can fully meet this need. Here, the source of power moves right along with the tool and the tool moves right along with the work.

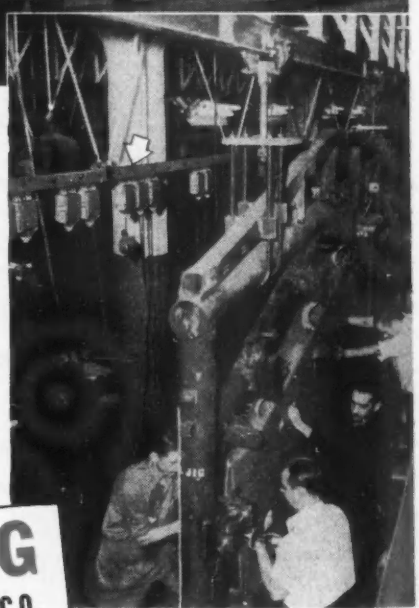
Gone are the hazards and interruptions caused by fixed plug-in points. With Industrial Trol-E-Duct, safety goes up, production time goes down and extensive savings are effected in wiring and other fixed equipment.

Because of its special enclosed design it is ideally adapted to crane and hoist applications in place of the dangerous open trolley wire.

Write for descriptive folder giving complete details.



BullDog's new "T" type sliding disc trolley conserves critical material without any sacrifice of operating effectiveness.



How power follows the tools in another big war plant building wings for combat planes.

BULLDOG
ELECTRIC PRODUCTS CO.
Box 177, R. Pk. Annex
Detroit 32, Michigan
BullDog Electric Products of Canada, Ltd., Toronto, Ontario
Field Engineering Offices in All Principal Cities

In addition to its three famous lines of Bus Duct, BUStribution DUCT for *"plug-in"* power, Universal Trol-E-Duct for *flexible lighting* and Industrial Trol-E-Duct for *movable "loads,"* BullDog Electric Products Company manufactures a wide line of other products for power distribution and control, including Vacu-Break Safety Switches, SafToFuse Panelboards, Circuit Master Breakers and Switchboards.

SAFEGUARDING THE HELICOPTER'S HEART

One feature that has played an important part in the success of the Sikorsky helicopter is the development of "cyclic pitch control."

The mechanism that operates this control passes through the main rotor hub.

It is the heart of the helicopter.

And you will find this heart fastened safely and securely with Elastic Stop Nuts.

These are the nuts with the red elastic collar—the nuts which have revolutionized aircraft construction.

That red collar hugs the bolt and grips tight. It does not loosen under vibration or shock. It locks fast—anywhere on the bolt.

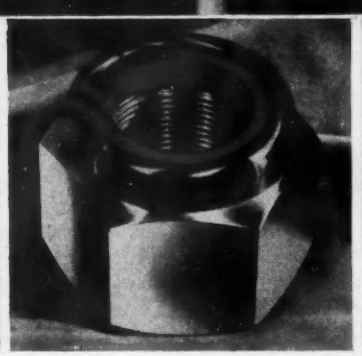
Nevertheless, you can take Elastic Stop Nuts off, and put them back on, time and time again, and they still retain their locking effectiveness.

Elastic Stop Nuts are going to prove godsends in countless postwar fastening problems. They will make products safer, better and longer lasting.

Any time you wish, our engineers will be glad to help with whatever fastening job you might have. They will recommend the correct Elastic Stop Nut to meet the situation.

Elastic Stop Nuts are an old story on Sikorsky aircraft. They have been used on the Sikorsky clipper ships for years. They are found throughout the helicopter holding important structural fastenings.

LOCKED ON THE BOLT BY THE ACTION OF THE GRIPPING RED COLLAR.
THE COLLAR IS ELASTIC, THE NUT CAN BE USED TIME AND TIME AGAIN.
MADE IN ALL SIZES AND TYPES—WITH THREADS TO FIT ANY STANDARD TYPES OF BOLTS.



ESNA

TRADE MARK OF

ELASTIC STOP NUT CORPORATION OF AMERICA
UNION, NEW JERSEY AND LINCOLN, NEBRASKA

ELASTIC STOP NUTS

Lock fast to make things last

No Oil "Absenteeism"

IN BEARINGS SEALED WITH AMERICAN BEARING FELTS!

To keep lubricants *in* — and to keep *out* dust, grit, moisture and other saboteurs of non-stop bearing performance — use fine quality American Bearing FELTS. These special FELTS, made from white, fine fibre new wool, meet the most exacting requirements for all types of ball and roller bearings.

Frictionless contact is the secret of FELT'S admitted superiority for this major application. FELT Retainers alone fit snugly to the shaft—supplying lubrication *when* and *as* needed—yet set up no friction to slacken speeds. American Bearing FELTS are also impervious to heat generated in normal bearing operation. Fibres remain fixed and FELT structure firm. By selecting Bearing FELTS of the correct density, lubricants of any viscosity can be employed for high or low shaft speeds.

Helping to speed victory production—increasing service life — and preventing costly shut-downs, FELT Retainers are "cut to your order", in three decimal tolerances. Our facilities for the mass production of cut FELT parts assure prompt delivery—and absolute uniformity on reorders. *American Felt Company* engineers are available to explain the latest techniques in bearing lubrication — or to advise on any other FELT application. The obligation is always ours.

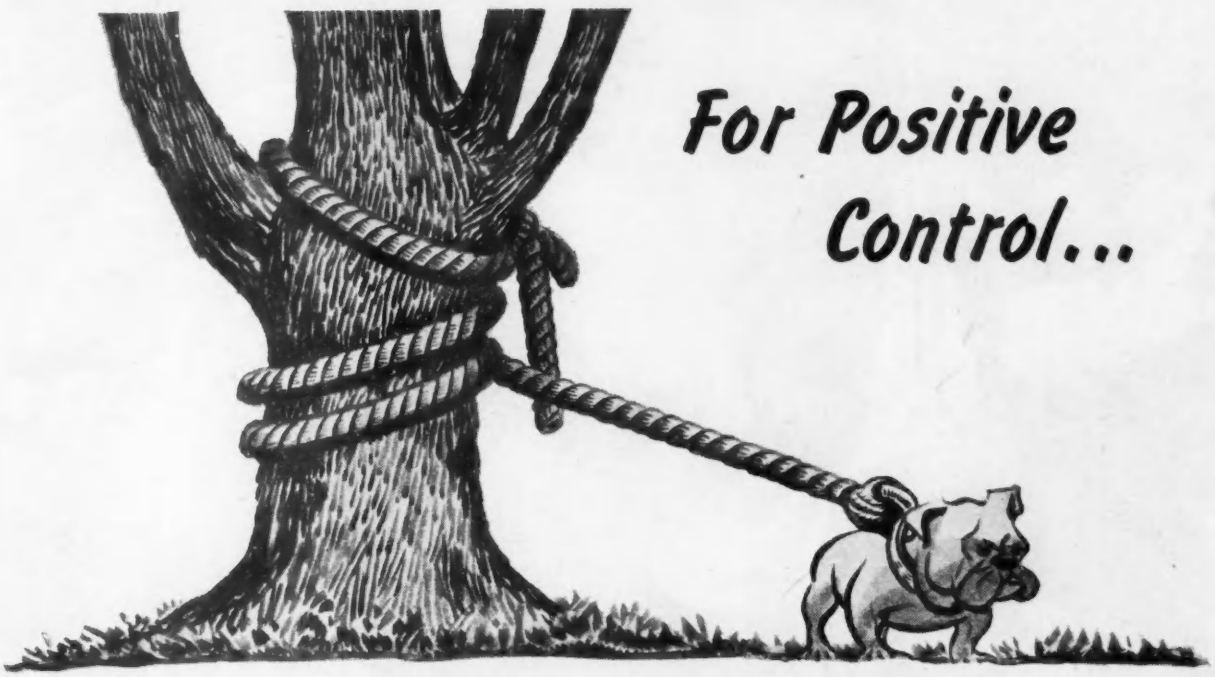
American Felt Company

TRADE MARK

General Offices: GLENVILLE, CONN.

Sales Offices at New York, Boston, Chicago, Detroit, Philadelphia, Cleveland, St. Louis, San Francisco, Dallas, Seattle, Los Angeles

PRODUCERS OF FINEST QUALITY FELT PARTS FOR OIL RETAINERS, WICKS, GREASE RETAINERS, DUST EXCLUDERS, GASKETS, PACKING, VIBRATION ISOLATION, INSULATION AND SOUND ABSORPTION FELTS



For Positive Control...

DU PONT METAL CYANIDES

DU PONT METAL CYANIDES are easy to use, readily dissolved in cyanide solutions without introducing inert salts into the plating bath. Specific advantages resulting from the use of these Metal Cyanides include:

FASTER PLATING—Absence of inert salts permits high current density and consequent rapid deposition of metal.

LOW UNIT COST—Saves time, labor and overhead charges per unit of metal plates. High-speed plating at lower chemical cost.

POSITIVE CONTROL—Bath can be kept at normal strength and balanced at all times by replenishment with required quantities of Metal Cyanides, Sodium Cyanide and conducting salts. Minimum inert salts permit highest efficiency, ready control without excessive increases in density of bath.

Further information can be obtained from Du Pont Technical Service. And remember, when you call Du Pont, you're calling on a group of highly specialized technical men ready to help you with knowledge gained from many years' experience. They will help you choose the process and materials best suited to different requirements. Write, wire or telephone: E. I. du Pont de Nemours & Co. (Inc.), Electroplating Div., Wilmington, Del.

METAL CYANIDES

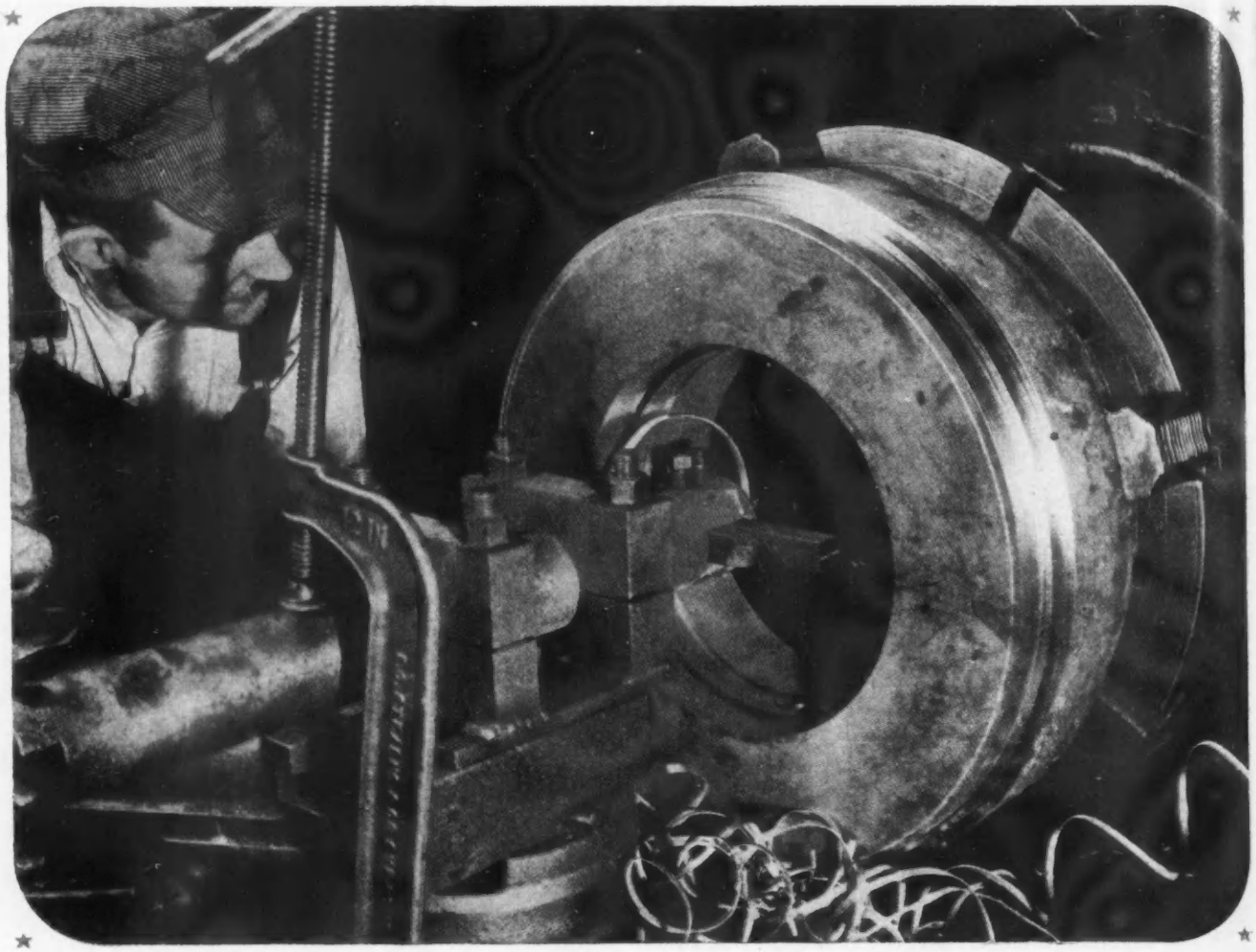
- **SODIUM CYANIDE—96% minimum**
- **COPPER CYANIDE—70-71% copper**
- **ZINC CYANIDE—55-56% zinc**
- **SODIUM GOLD CYANIDE—46% gold**
- **POTASSIUM GOLD CYANIDE—41% gold**
- **SILVER CYANIDE—80-80½% silver**

Let's All BACK THE ATTACK!

DU PONT
REG. U. S. PAT. OFF.

DU PONT CHEMICALS • PROCESSES • SERVICE
for ELECTROPLATING

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*



Ready Now FOR YOUR *Super* CUTTING JOBS ...*Super DBL* HIGH SPEED STEEL

NO COMPLICATIONS IN HEAT TREATMENT OR HANDLING

For any shop man familiar with the techniques used on tungsten cobalt steels, or on the 18-4-1 and tungsten-moly analyses, there will be nothing new in the handling and treatment of *Super DBL*. It also conforms to standard in the forms and finishes available, which include regular sizes of mill-treated tool bits and can be supplied from Allegheny Ludlum warehouse stocks, as well as distributors, in principal cities coast to coast.

ALLEGHENY LUDLUM mill technicians developed this new High Speed Steel to fill a dual role: first, to meet government requirements for the conservation of strategic materials; and second, to give you a higher degree of hardness and cutting stamina than has been previously available in steels which meet the conservation need.

Super DBL (a low-tungsten, molybdenum, cobalt steel) has been thoroughly tried and tested in service—it's ready to take on your heaviest-duty production work. Use it on hard, gritty castings—on heat treated alloy or stainless steels—on any rough and tough cutting job in the shop with full assurance of maximum red hardness and performance. ● For full data on properties, treatment and use, write for the *"Super DBL* Blue Sheet."

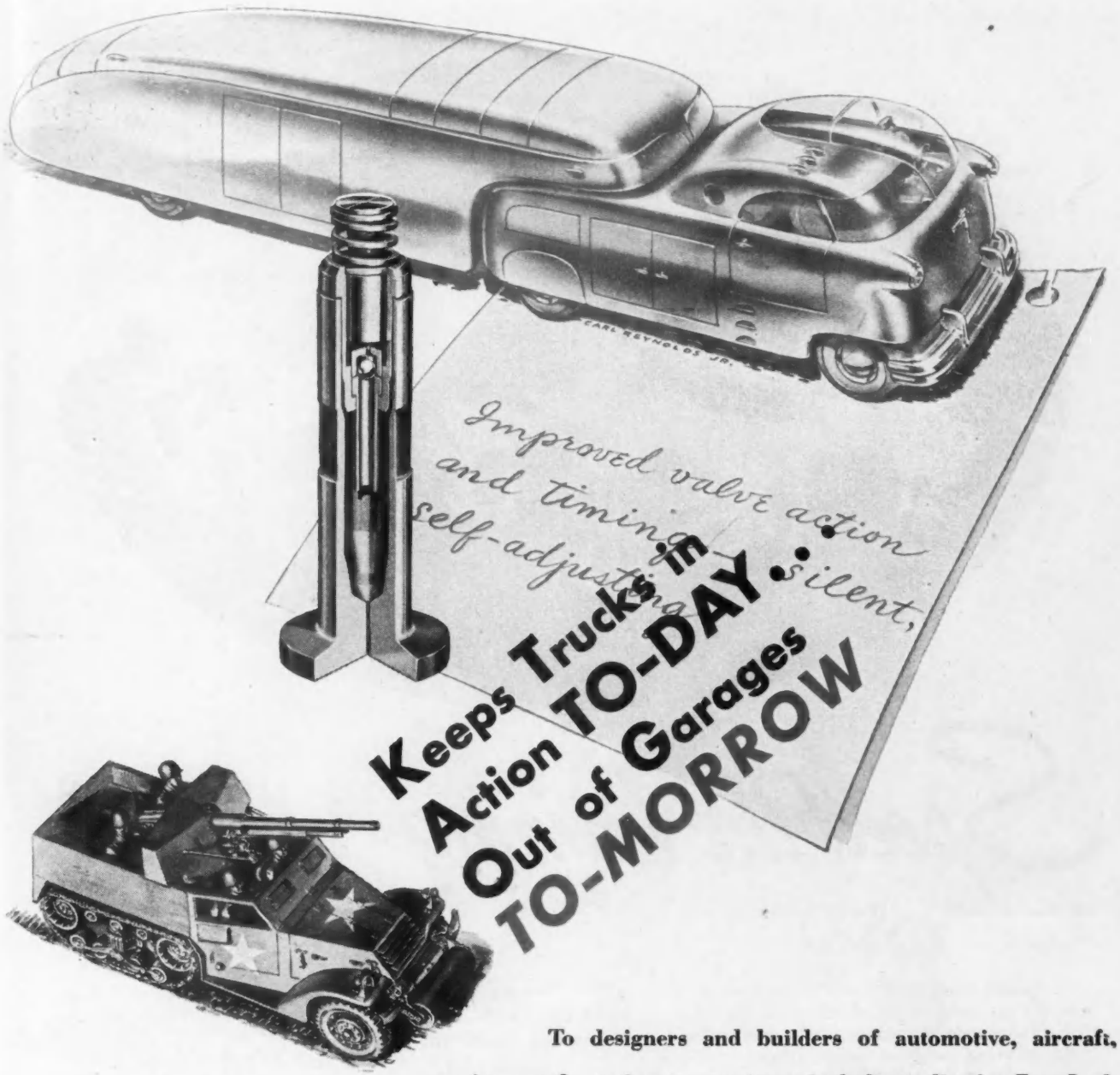
ADDRESS DEPT. AI-20

AL

STEEL FOR THE NATION'S WELFARE

Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

A-9074 . . . W&D



Keeps Trucks in Action TO-DAY • Out of Garages TO-MORROW

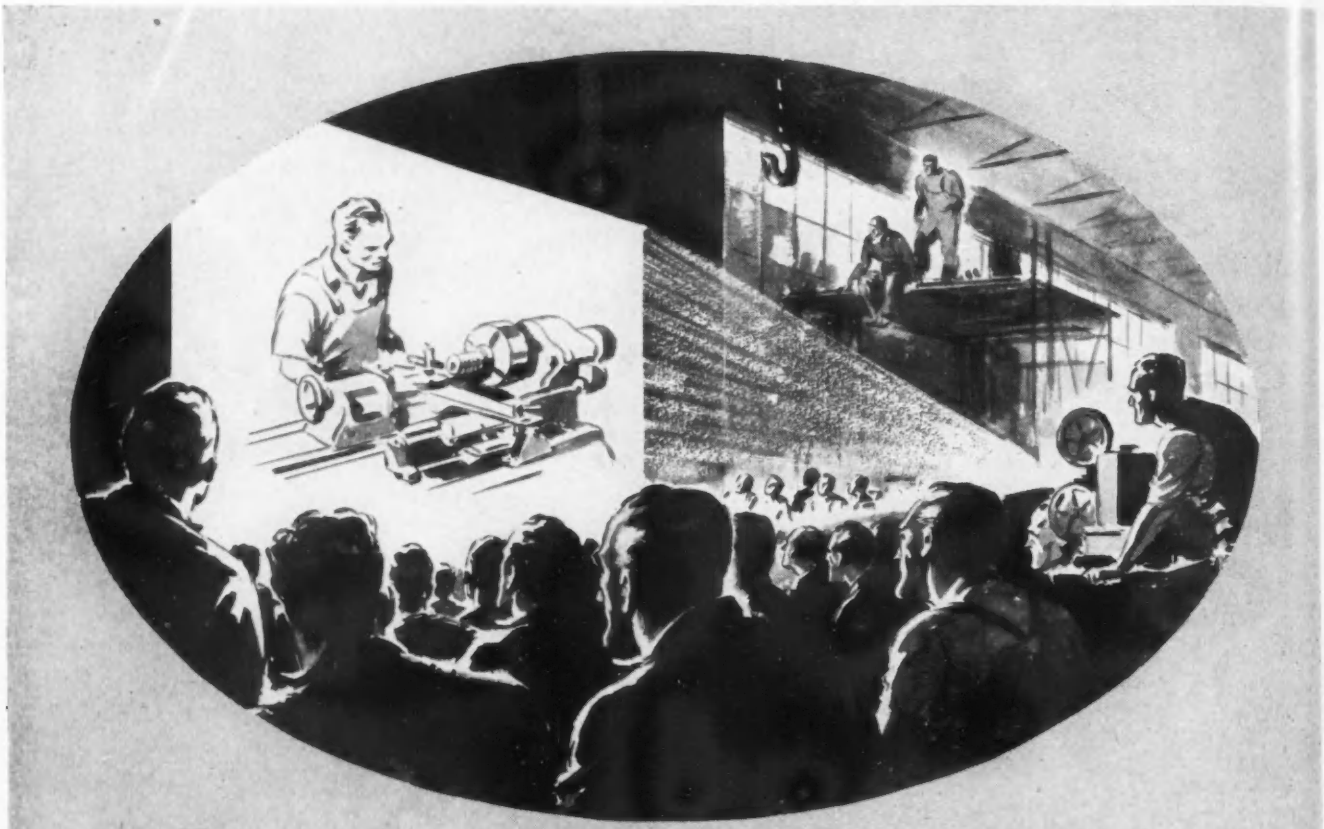
To designers and builders of automotive, aircraft, marine, and stationary engines—including diesels—Zero-Lash Hydraulic Valve Lifters offer a number of important advantages. Among these are (1) freedom from tappet adjustment for the life of the engine, (2) longer life of valve and seat, (3) accurate valve timing, (4) improved engine performance and simplified design, and (5) silent operation. Write for illustrated booklet.

THE ZERO-LASH HYDRAULIC VALVE LIFTER IS ENGINEERED AND MANUFACTURED BY THE WILCOX-RICH DIVISION OF EATON MANUFACTURING CO., 9771 FRENCH ROAD, DETROIT (13).

Zero-Lash

HYDRAULIC VALVE LIFTERS

SILENT • ENDURING



Speed the Training OF NEW LATHE OPERATORS

Skilled manpower is one of the most critical of all war industry problems today. To replace the thousands of skilled machinists called to the services, new and inexperienced men and women workers must be trained to carry on the battle of production.

To help with the training of new lathe operators, South Bend offers a complete training program of sound films, reference books, manuals, wall charts, and bulletins. These represent an authoritative and effective course in lathe operation and modern shop practice. The 16 mm color, sound films have been adapted from South Bend's well known reference and text book, "How to Run a Lathe," now in its 42nd edition.

We are pleased to offer these films and instructional literature to industries and schools conducting pre-employment training classes.

WRITE FOR INFORMATION ON THESE PRACTICAL TRAINING HELPS

MOTION PICTURES—
"The Lathe" and "Plain Turning"—two 16 mm sound films in color on lathe operation. Available on a free loan basis for apprentice training. Showing time 20 minutes each. Write for Circular No. 8-A.

HOW TO GET THE MOST OUT OF YOUR LATHE—
Specialized service bulletins on the care and operation of engine lathes. H-1, "Keep Your Lathe Clean"; H-2, "Oiling the Lathe"; H-3, "Installing and Leveling the Lathe"; H-4, "Keep Your Lathe in Trim." Sample copies mailed on request.

HOW TO RUN A LATHE—
A practical 128-page operator's handbook. 360 illustrations. Written in simple and non-technical style. Used as a shop text book by the Army, Navy and Air Corps. Price 25c. Sample copy free to apprentice supervisors.

THREAD CUTTING—
21-page book, "How to Cut Screw Threads in the Lathe." Shows how to set up a lathe for cutting various pitches of screw threads, setting cutter bits, screw thread formulae, metric threads, etc. Price 10c. Sample copy free to apprentice supervisors.

GRINDING CUTTER BITS—
12-page book on grinding lathe tool cutter bits. Covers identification and application of various bits, methods of grinding, correct angles, etc. Price 10c. Sample copy free to apprentice supervisors.

ARMY E NAVY

BUY WAR BONDS!

SOUTH BEND LATHE WORKS · Lathe Builders for 37 Years · South Bend 22, Ind.

The illustration shows a Baldwin Southwark straightening press at work in one of our country's largest Navy yards.

THE NAVY KNOWS HOW

Choosing the proper equipment to achieve a desirable result is not an easy task. The U. S. Navy knows how, as a glorious history indicates. It is tribute to Baldwin Southwark presses to find the Navy placing many of these presses in Navy yards throughout the country.

Baldwin Southwark shipyard equipment includes bending rolls, joggling presses, plate planers and keel benders.

Baldwin Southwark also produces hydraulic press equipment for all types of industries. The Baldwin Locomotive Works, Baldwin Southwark Div., Philadelphia, Pennsylvania, U. S. A.

BLW THE BALDWIN GROUP

BALDWIN
SOUTHWARK
HYDRAULIC PRESSES

. . . YOUR 4TH WAR LOAN QUOTA

WHETHER your plant meets its quota, or fails, lies largely in *your* hands. Your leadership can put it over—but if you haven't already got a smooth running, hard hitting War Loan Organization at work in your plant, there's not a minute to lose.

Take over the active direction of this drive to meet —*and break*—your plant's quota. And see to it that every one of your associates, from plant superintendent to foreman, goes all-out for Victory!

To meet your plant's quota means that you'll have to hold your present Pay-Roll Deduction Plan payments at their all-time high—plus such additional amounts as your local War Finance Committee has assigned to you. In most cases this will mean the sale of *at least* one $100 bond per worker. It means having a fast-cracking sales organization, geared to reach personally and effectively every individual in your plant. And it means hammering right along until you've reached a 100% record in those *extra* $100 —or better—bonds!

And while you're at it, now's a good time to check those special cases—*growing more numerous every day*—where increased *family* incomes make possible, *and imperative,* far greater than usual investment through your plant's Pay-Roll Deduction Plan. Indeed, so common are the cases of two, three, or even more, wage-earners in a single family, that you'll do well to forget having ever heard of '10%' as a reasonable investment. Why, for thousands of these 'multiple-income' families 10% or 15% represents but a paltry fraction of an investment which should be running at 25%, 50%, or more!

After the way you've gone at your wartime *production* quotas—and topped them every time—you're certainly not going to let anything stand in the way of your plant's breaking its quota for the 4th War Loan! Particularly since all you are being asked to do is to sell your own people the finest investment in the world—*their own share in Victory!*

LET'S ALL BACK THE ATTACK!

This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council.

POWDER METALLURGY

TO SERVE YOU BETTER

POWDER METALLURGY Inc. has become a subsidiary of GENERAL BRONZE CORPORATION and is now operating with new and enlarged facilities under the name of POWDER METALLURGY CORPORATION.

Save TIME AND MONEY

IN THE QUANTITY PRODUCTION OF SMALL METAL PARTS

WITH POMET

Under the stress of war-time demands, this plant has sped the development of powder metallurgy from the pioneer phases of a new process to practical production routines. Today Pomet parts are saving time, material and labor for many manufacturers who wish to combine high standards with quantity production. A wide variety of complicated parts can be produced quickly and economically using brass, bronze, aluminum, ferrous alloys and other metals, combinations of metals or metals combined with non-metallic powders.

POMET *also gives you these "PLUS" qualities:*

- **CLOSE TOLERANCES WITHOUT MACHINING** In many cases, finished pieces can be held to tolerances of plus or minus .001" or even closer, with all or most of the need for expensive machining eliminated.
- **DENSITY** Small parts which approach high technical density can be made. Complex Pomet parts often satisfactorily replace machine parts which were made by conventional methods.
- **CONTROLLED POROSITY** Pomet parts can be made with intentional porosity for special applications or porosity can be reduced to 5%.
- **WEAR RESISTANCE** Pomet parts can be made to resist strains and stresses such as tension, compression, shearing and abrasion and, in many cases, they out-perform the more expensive parts they replace.
- **DUCTILITY OR HARDNESS** When high ductility is a necessary characteristic, it can be incorporated in Pomet parts. Hardness is also a property that Pomet parts can give you when it is required.
- **COMBINED MATERIALS** Special combinations of metals, where two or more qualities are desired, can be satisfactorily accomplished in Pomet parts. Metals and non-metals can also be combined for the production of cutting and abrasive units.

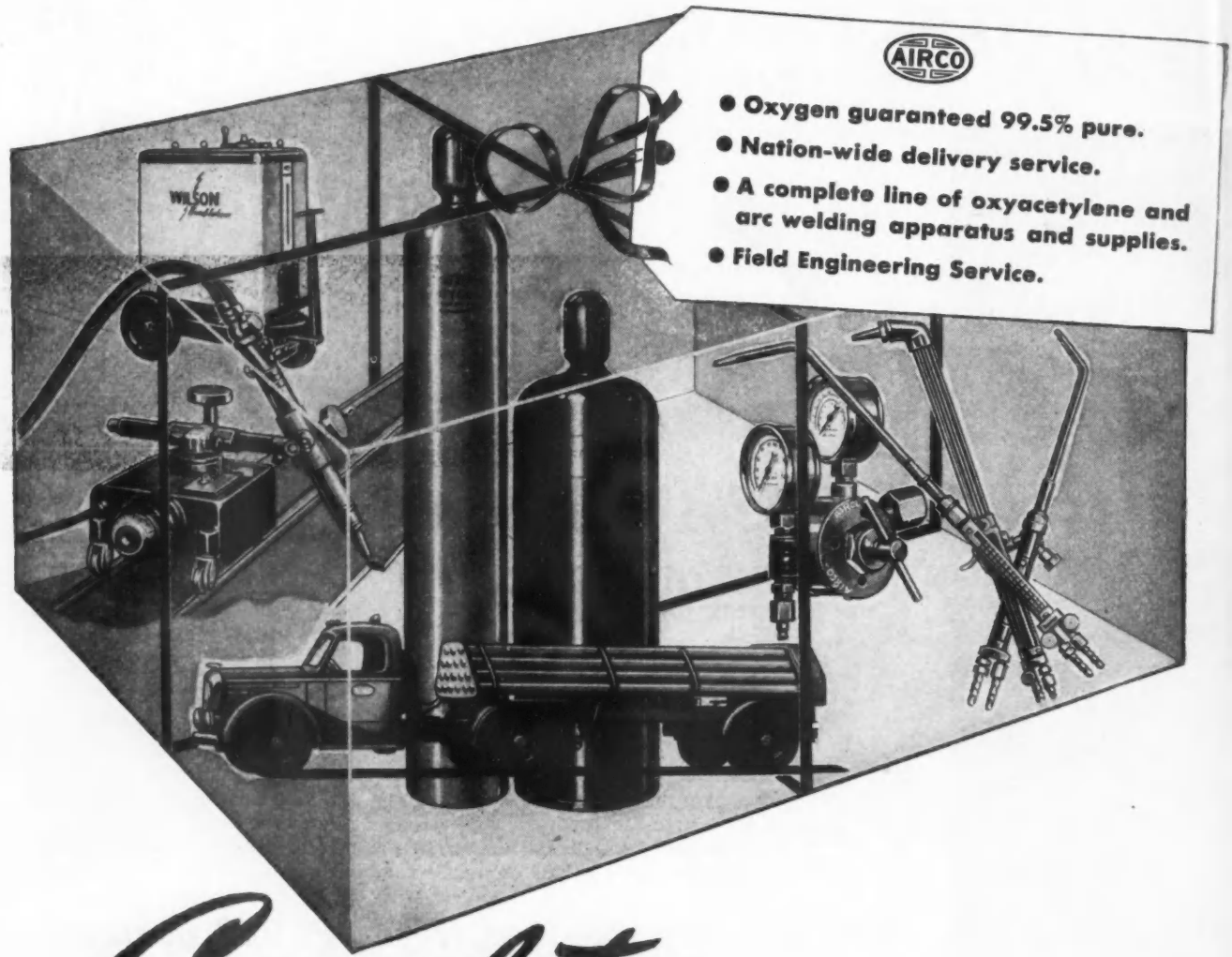
New and greatly expanded facilities now assure even faster production. Technical excellence is being maintained and constantly improved. In quantities of 20,000 and over Pomet parts are particularly interesting to manufacturers who have to keep cost in line with rigid specifications. We will be pleased to quote on blueprints and specifications, and are in a position to give you exceptional service. We shall also be glad to send interesting and informative literature on request.

POWDER METALLURGY

CORPORATION

A SUBSIDIARY OF GENERAL BRONZE CORPORATION

30-54 Greenpoint Avenue **Long Island City, N. Y.**


AIRCO
• Oxygen guaranteed 99.5% pure.
• Nation-wide delivery service.
• A complete line of oxyacetylene and arc welding apparatus and supplies.
• Field Engineering Service.
WILSON

A *Complete* OXYGEN SERVICE IN ONE PACKAGE...

Whether your needs are for 122 cu. ft.—20,000—or several million cubic feet of oxygen monthly, Air Reduction's complete service meets all your oxygen needs.

Airco oxygen is guaranteed 99.5% pure . . . uniform from coast to coast. It assures maximum speed and economy in metal cutting . . . promotes greater efficiency in welding. Airco's nation-wide network of offices and plants assures dependable deliveries to any point in the nation.

Air Reduction also manufactures a complete line of apparatus and supplies for welding, cutting and all other applications of the oxyacetylene flame and electric arc. In addition, its nation-wide Field Engineering Service offers technical aid—including development of mechanical flame and arc applications and design of gas pipeline systems for your plant.

Whatever your need for oxyacetylene welding and cutting, Air Reduction's complete service will meet all your requirements. There's an Air Reduction office located within close reach of your plant.

★ BUY UNITED STATES WAR BONDS ★

AIRCO WILSON

AIR REDUCTION

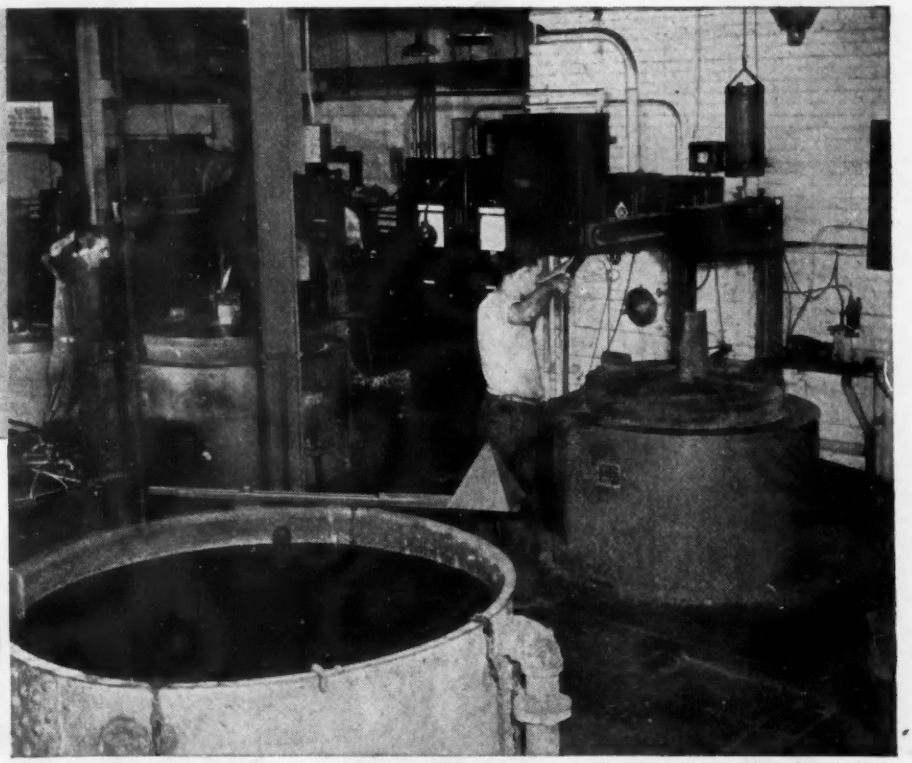
General Offices: 60 EAST 42nd STREET, NEW YORK 17, N. Y.

In Texas: MAGNOLIA AIRCO GAS PRODUCTS CO. • General Offices: HOUSTON 1, TEXAS

Offices in all Principal Cities

A Yale Padlock's shackle, actual size.

Cross Section, enlarged to show skin-deep hardening.



Two of Yale & Towne Mfg. Co.'s Homocarb Furnaces, used in the Stamford, Conn., plant for shallow-case gas-cyaniding of lock shackles as well as for straight Homo Carburizing.

How Yale & Towne Harden Shackles *Skin Deep*

The problem in hardening the above-shown shackle for a Yale padlock is to give its tough but soft steel a file-hard non-brittle skin. This skin or case must be only 0.008″ to 0.012″ thick, depending on size; it must be within a fraction of a thousandth of the specified thinness; and it must be extremely uniform.

These "musts" have long been met by the use of one of the old-established case-hardening methods. But, when "Homo-cyaniding" became available a few years ago, Yale & Towne executives decided to review the situation. They investigated; tried the Homo-cyanide method thoroughly, and have now adopted it because it gives great uniformity and is clean, quick and automatically controlled. The operation is as follows:

Twenty-five hundred shackles (260 lbs), are divided between three alloy trays, which are then nested in the Homocarb Furnace.

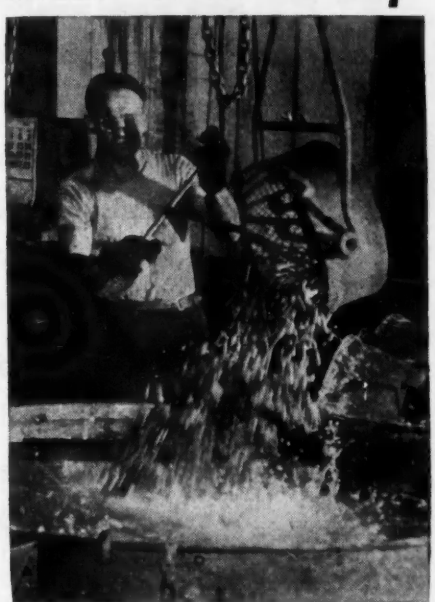
Forced-convection heating by the genuine Homo Method brings the load rapidly and uniformly up to the gas-cyaniding temperature of 1550 F.

After loading the furnace the heat-treater starts an automatic injector which feeds Homocarb Fluid into the furnace. This fluid "cracks" to form Homocarb gas; both prevents scale and carburizes. Then, at the proper point in the cycle, a small, steady flow of ammonia is admitted.

The ammonia and Homocarb gas, mixed and distributed through the load, reacts with the steel to form the intensely hard case required. Because the Homo Method distributes the mixture so thoroughly, the case is highly uniform; and because the Micromax Temperature Control holds the heat so constant, the thickness of the case is regulated with great exactness by simply soaking for the desired time.

The heat-treater therefore has only to watch the time, and quench promptly in brine, to get the correct structure. There are practically no rejects of these urgently war-needed parts.

If you have a gas-cyaniding problem, outline it and an L&N engineer will either call or send Catalog T-623, as you prefer.



Quenching shackles in brine. The pyramidal spreader, on end of steel rod, scatters shackles so that each is quickly and thoroughly quenched to make its Homo-cyanided surface file-hard.

Ind Ad T-623(17)

depends on me!

A Slogan For Every American

LEEDS & NORTHRUP COMPANY, 4966 STENTON AVE., PHILA. 44, PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

AN ~~AXE~~ AXIS TO GRIND

WAR challenged the Abrasive Industry with a big part in a big job — helping grind down the Axis!

Abrasive Company Grinding Wheels have been answering that challenge. The experience has been a fruitful one. To half a century of skill have been added new ideas, new methods, new advances.

Today, Abrasive Company "grinds" at top speed to finish this war job. Tomorrow, "Abrasive" will be more than ever able to serve American Industry with abrasive products whose Password is PERFORMANCE, whose Watchword is DEPENDABILITY and whose Buyword is long-run ECONOMY.

"COMMANDING QUALITY ★ OUTSTANDING RESULTS"

ABRASIVE

ABRASIVE COMPANY

DIVISION OF SIMONDS SAW AND STEEL CO.

TACONY & FRALEY STS., PHILADELPHIA, PA. • CHICAGO BRANCH: 127 SOUTH GREEN ST.

DISTRIBUTORS IN ALL PRINCIPAL CITIES

3 steps to broader fields of Usefulness

When your production men discuss new materials in postwar use we are asking you to think about woven cloth — the material that serves you in more ways than does any other, and in many ways for which no other material can satisfactorily substitute. Think of cloth as is, then as joined with the magic of chemistry to solve your material problem.

CURRENT HOLLISTON PRODUCTION includes COATED AND IMPREGNATED FABRICS . . . INSULATING CLOTH BASE . . . SEPARATOR CLOTHS rubber, starch-filled, glazed. TRACING AND BLUE PRINT CLOTHS white and blue, ink or pencil. MAP CLOTH, PHOTO CLOTH, self-adhesive. REINFORCING FABRICS. SIGN, LABEL AND TAG CLOTHS, waterproof to take any ink, meet any inking problem. BOOK-BINDING CLOTHS. SHADE CLOTH, impregnated waterproof, opaque, translucent or light proof.

We urge you to consider CLOTH; and invite you to consult with us concerning possibilities and developments for your specific requirements.

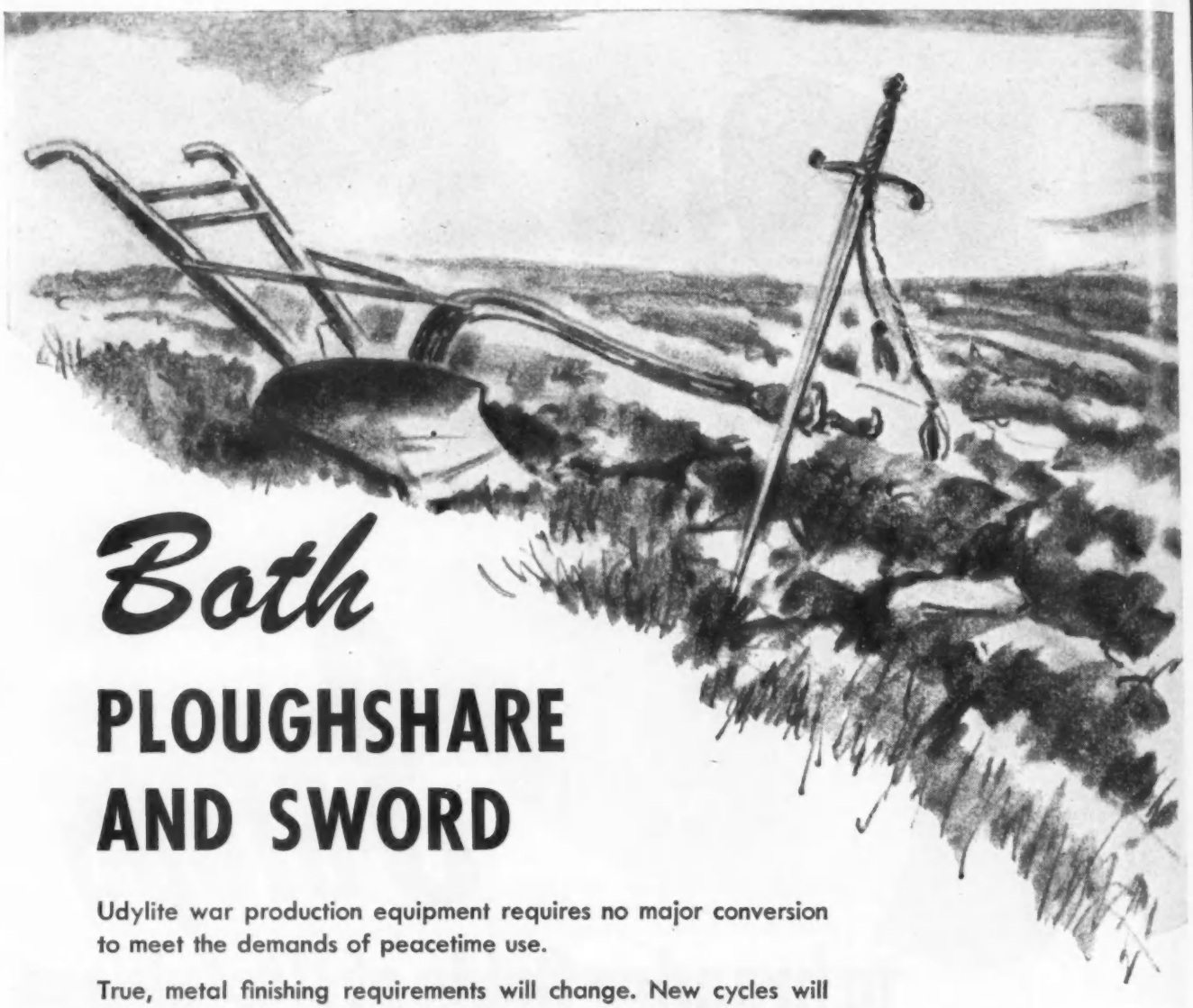
IMPREGNATING

The word impregnating has several trade meanings. We use it to describe a method of forcing a plastic mass into the fibres of the threads of a woven fabric to accomplish many and diverse purposes — waterproofing, fireproofing, mildew-proofing, strengthening, stiffening, etc.

Impregnating may or may not affect the appearance, flexibility and bulk of the cloth, depending upon the result desired. The possibilities of cloth impregnating are as limitless as the field of chemistry and plastics. Impregnating is one of three major steps in preparing cloth for special needs.

We start with cloth, and through knowledge of processing, plus adequate research facilities, add special properties for special needs.

The Holliston Mills, Inc.
PROCESSORS OF CLOTHS FOR SPECIAL PURPOSES
NORWOOD, MASSACHUSETTS
Sales Agents in Principal Cities



Both

PLOUGHSHARE AND SWORD

Udylite war production equipment requires no major conversion to meet the demands of peacetime use.

True, metal finishing requirements will change. New cycles will be required. New products will demand new handling but through it all your basic metal finishing tools will not change—the faithful "swords" of war will become the "plowshares" of peace.

Udylite metal finishing equipment has proved its worth under the strain of wartime performance, the same engineering and dependable quality which enabled it to withstand the rigors of forced production will make Udylite equipment doubly valuable in normal times.

Udylite's staff of experienced engineers offer you the country's most complete line of dependable polishing, plating and anodizing equipment backed by their years of technical "know how". Start RIGHT with Udylite equipment.

Call or write Udylite for your Metal Finishing requirements.

THE UDYLITE CORPORATION

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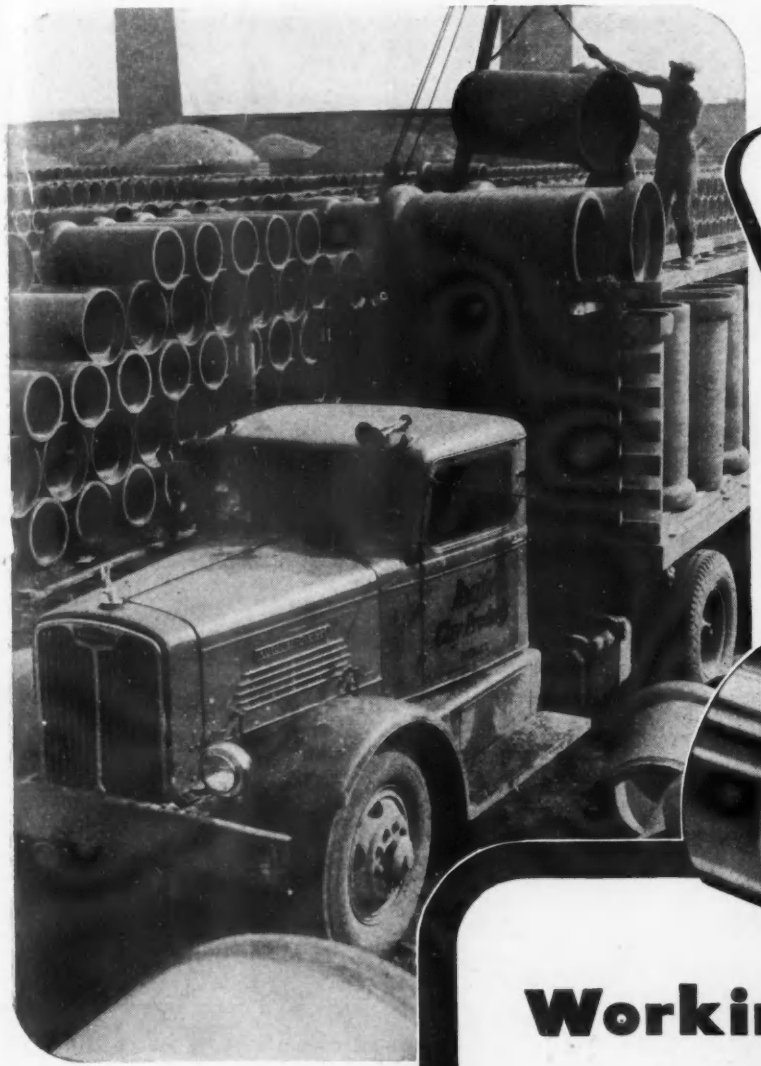
Long Island City 1, N. Y.
11-16 44th Drive

Cleveland 3
4408 Carnegie Ave.



Working full time *for Uncle Sam*

There's no bedtime for SKF Bearings on the critical turning parts of this Autocar Truck. The only time they retire is when the truck rests after a gruelling day of moving vital war materials. *Every* minute they're on the alert for radial and thrust loads... ready to accept the unexpected jolts and shocks often encountered in rough going. When a truck doesn't stop for bearing trouble, it's apt to do a full-time job for Uncle Sam. 5444

SKF INDUSTRIES, INC., PHILA. 34, PA.

SKF

ball and roller bearings

That they may *breathe and live and fight*

OXYGEN TANKS OF
N-A-X 9115 ALLOY STEEL

Up in rarefied, sub-zero skies, the lives of aviators and air-borne wounded depend on the oxygen tank—an item in which steel requirements are especially severe and complex.

Here, the metal must be *tough* with tensile strength to withstand high operating pressures and take the impact of gun fire without shattering . . . yet weight restrictions necessitate the use of a comparatively light gauge sheet, and critical steel making alloys have to be conserved.

In addition to these specifications, the steel has to have the properties necessary for atomic hydrogen arc welding on fully automatic equipment.

This difficult and important problem has been solved successfully by Chambers Corporation of Shelbyville, Indiana. They spent over a year in development work, and they selected N-A-X 9115 Alloy Steel as their basic material . . . Write for our new book on N-A-X 9100 Series Steel. It may help you solve other vital problems.

DUCTILITY — ITS INHERENTLY FINER GRAIN MAKES ALL THE DIFFERENCE — OF STRENGTH

GREAT LAKES STEEL CORPORATION

DETROIT, MICHIGAN

Sales Offices in Principal Cities

Division of **NATIONAL STEEL CORPORATION** *Executive Offices, Pittsburgh, Pa.*

NATIONAL STEEL CORPORATION

NOW!

JOHN CRANE PUMP SEAL

IS STANDARD EQUIPMENT IN WIDE RANGE OF SERVICES FOR SMALL ROTARY AND CENTRIFUGAL PUMP SHAFTS

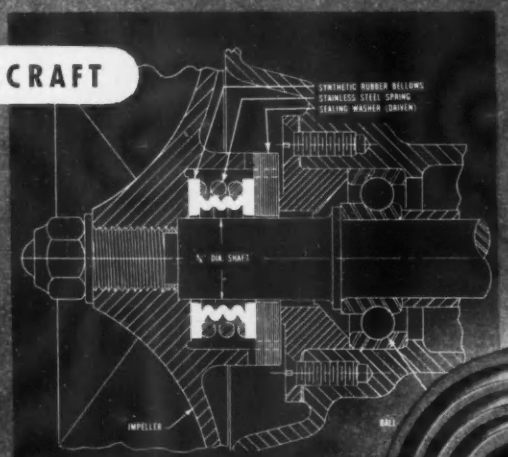
Only 2 parts—*Bellows* and Spring

Seals on ends—not on shaft

Seal does not touch shaft

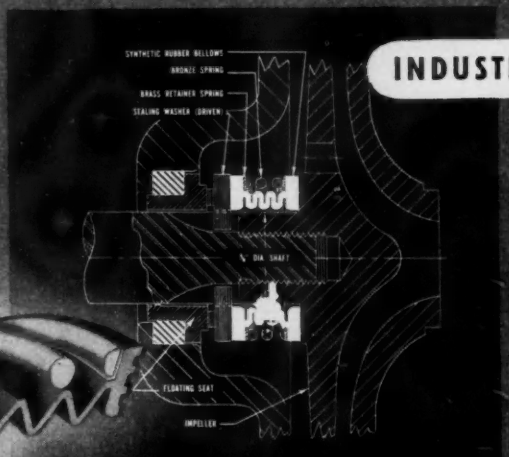
Fluid-tight! Impervious to liquids and grease

AIRCRAFT



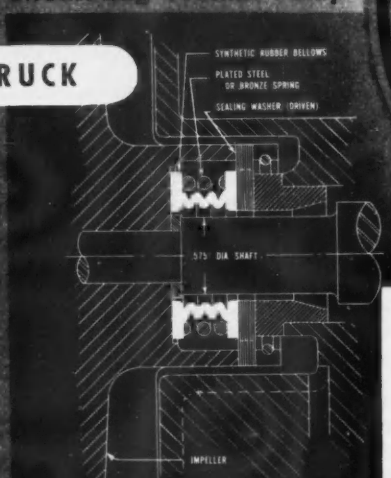
Circulating Coolant Pump

INDUSTRIAL



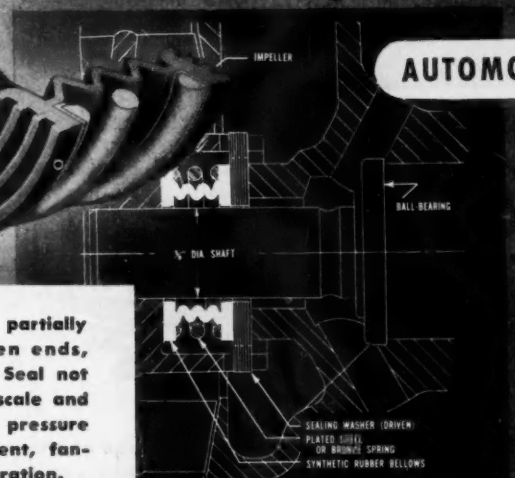
Centrifugal Oil Pump

TRUCK



Circulating Water Pump

AUTOMOBILE



Automobile Water Pump

• Installed bellows is partially compressed between ends, revolves with shaft. Seal not affected by rust or scale and instantly adjusts to pressure variation, misalignment, fan-thrust, torque or vibration.

• Test this seal! Designers, engineers and manufacturers are invited to submit blue-prints. We furnish, without charge, drawings showing adaptations for your equipment.

CRANE PACKING COMPANY

1818 CUYLER AVE. • CHICAGO 13, ILL.

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CRANE PACKING CO., LTD., Hamilton, Ontario, Canada.
Branches: Montreal, Toronto, Vancouver

Eyes that see new worlds

THE toy top which amused children at the turn of the century brought a new invention to America, an invention that is playing a vital part in the defense of democracy and in assuring freedom to the whole world.

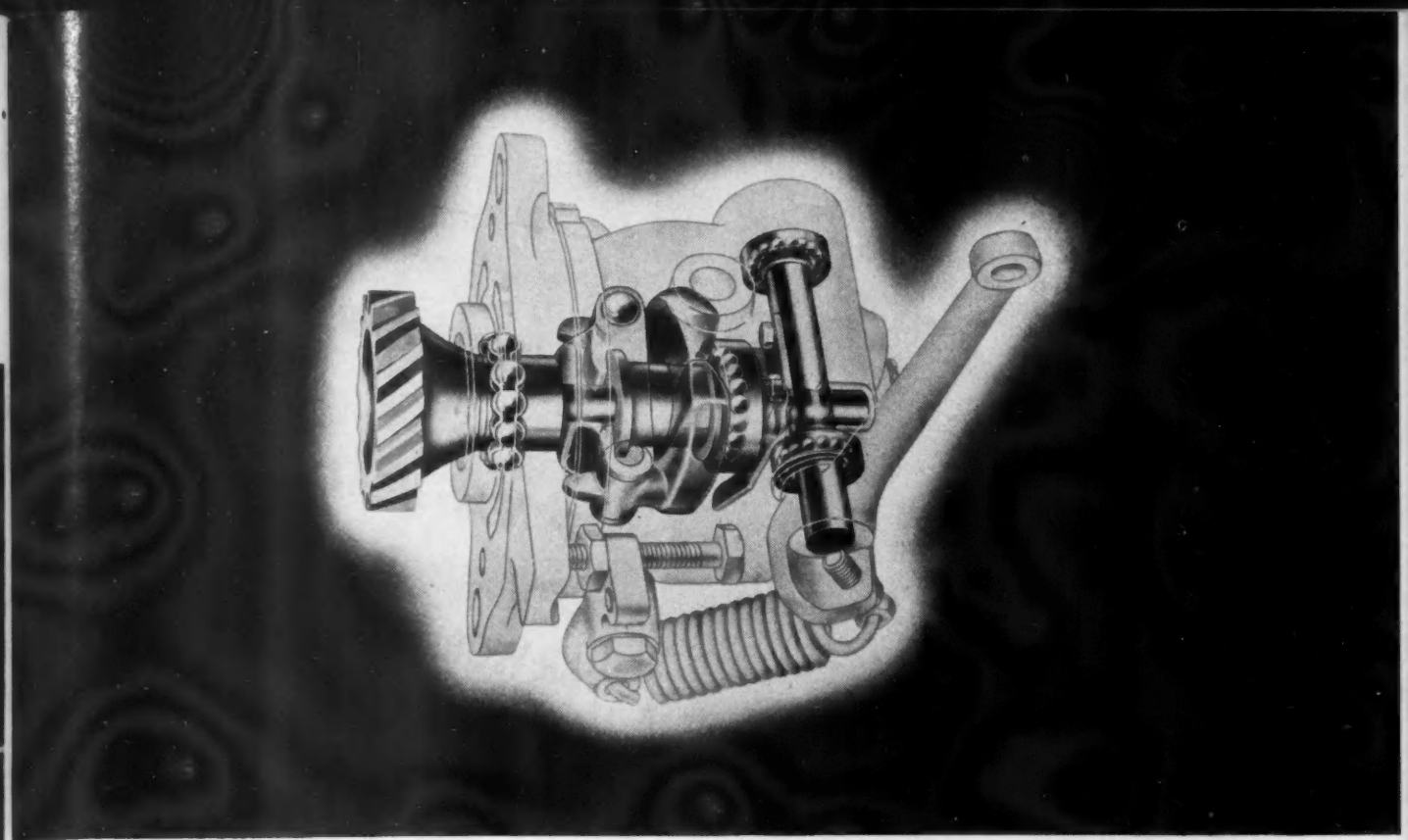
Today, as the gyro-compass, the gyroscope which was inspired by the toy top, guides ships through trackless oceans unerringly to their destinations. As the gyro-pilot, it helps make possible the successful accomplishment of wartime missions by our mighty bombers. Gyro-stabilizers keep torpedoes fired from our submarines at proper depth—steer their course to targets as they blast enemy fleets from the seas.

Auto-Lite contributes to these Davids of modern war through the production of Sperry GYROPILOTS and Sperry Directional Gyros. It is just one of the ways Auto-Lite dependability and precision engineering is serving the Armed Forces of the United Nations in all 26 Auto-Lite manufacturing divisions.

SARNIA, ONT. **THE ELECTRIC AUTO-LITE COMPANY** TOLEDO, 1, OHIO

BUY WAR BONDS

AUTO-LITE



This phantom view of a typical Pierce Flyball Governor illustrates the time-proven flyball principle embodied in more than 2000 different Pierce Governor assemblies

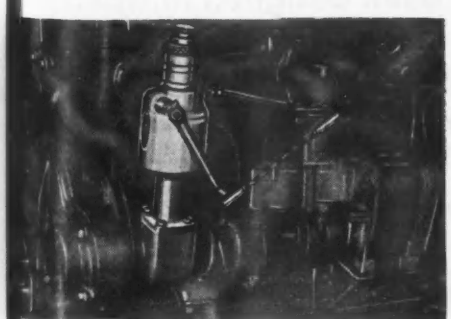
Governing Efficiency is Increased

with Provision for a Direct Governor Driving Outlet!

● Further advances in the art of close, split-second governing on internal combustion engines are resulting from the necessity of meeting and solving new war-time governing problems.

But the benefit of these advances *cannot* be fully realized by governor users, unless their engines are provided with outlets which permit an *equally* efficient governor drive.

It is easy to give your engines this advantage while you are planning new engines for production . . . now or later . . . by incorporating a direct driving outlet for the governor in your new designs. There are a number of convenient ways of doing this, and Pierce engineers are at your service to help you with this problem.



The Vertical Type Industrial Governor, shown at the left, is only one of the more than 2000 different governor assemblies engineered by Pierce. This model is designed for use on engines where the manufacturer has made provision for a direct governor driving outlet.

THE PIERCE GOVERNOR COMPANY, INC.
1637 OHIO AVENUE · ANDERSON, INDIANA

Manufacturers of Pierce Precision Governors and Sisson Automatic Chokes

Pierce Governors

STANDARD SINCE 1913

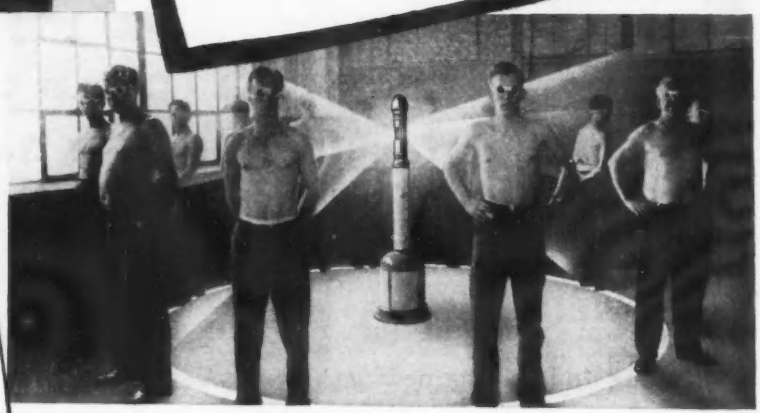
KEEP 'EM HAPPY

KEEP 'EM HEALTHY

WAR WORKERS ENJOY TAKING ULTRAVIOLET BATHS THAT HELP KEEP THEM ON THE JOB!

The Hanovia Lighthouse Ultra-violet Lamp is an efficient time-saving, effective ultra-violet generator for group irradiation.

*Tests have proven ultra-violet one of the best and most dependable mediums for reducing absenteeism resultant from common ailments.



*Results of these tests available upon written request.

Send for Free booklet, "FITNESS IN INDUSTRY"

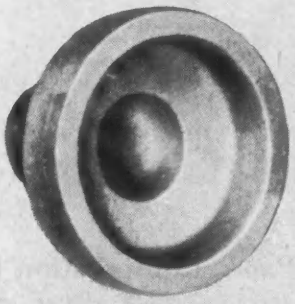
Address--Industrial Solarium Dept. A

HANOVIA
CHEMICAL & MFG. CO.
NEWARK, N. J.

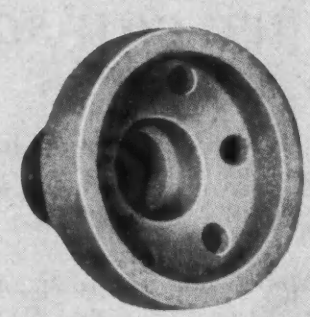
World's largest manufacturers of Ultra-violet Equipment for the Medical Profession and Industry.

This Lighthouse has been created for the ultra-violet irradiation of groups of persons. It has been designed to stand upon the floor in the center of an area about twelve feet in diameter where employees can walk or stand about the lamp at an average distance of five feet. Fifteen persons can be accommodated at one time at five feet distance ..the ultra-violet application involving only a few minutes.

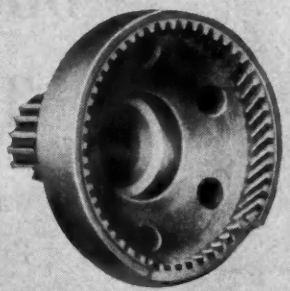
THE LIGHTHOUSE IS STURDILY BUILT, EASY AND ECONOMICAL TO INSTALL, MAINTAIN & OPERATE



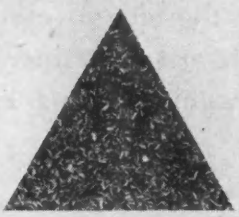
Former stock, 8-2/10 lb.
4-9/10 lb. of metal
to be removed.

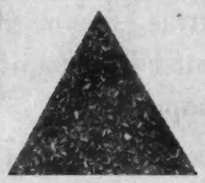


ArmaSteel casting, 5-7/10 lb.
2-4/10 lb. of metal
to be removed.



Finished part, 3-3/10 lb.





2-5/10 Pounds Less Metal to be Machined on Transmission Drum for Tank

These comparative figures indicate part of the saving effected by ArmaSteel: Weight of forging formerly used — 8-2/10 pounds; weight of ArmaSteel rough casting—5-7/10 pounds; weight of finished part—3-3/10 pounds.

Chips Are Out When "The Chips Are Down"

ArmaSteel*

With wartime schedules calling for more and more efficiency in the utilization of time and manpower, men who "call the signals" on plant production begrudge the hours wasted turning out chips.

That's one reason why ArmaSteel castings have replaced steel forgings and bar stock in the production of many vital parts. Cast to conform closely to finished shapes, they cut down machining time as much as 50 per cent—reduce the volume of chips and step up the volume of production. On top of this saving, ArmaSteel is far more machinable than the alloy steels it replaces, stretching the period of service between tool grinds.

Other qualifications of ArmaSteel include exceptional adaptability to selective hardening, high fatigue life, good corrosion resistance and excellent bearing properties. Investigate the advantages of applying ArmaSteel to your immediate production, and keep ArmaSteel in mind for products in the blueprint stage.

SAGINAW MALLEABLE IRON
DIVISION OF GENERAL MOTORS
Saginaw, Michigan

You'll be glad you did
BUY EXTRA
WAR BONDS

*Reg. U. S. Pat. Off.

CAST FOR A LEADING ROLE IN INDUSTRY

"Boys, let's put our heads together and see how much paper and paper board we can save!"

THAT'S the spirit. That's what we've all got to do to lick this problem of getting enough paper and paper board for Army and war-production use.

Every company has got to organize a Paper Conservation Committee and tackle the problem with all the gumption and the brain power at their command.

Paper inventories must be checked with the idea of eliminating peacetime extras. From stationery to board containers, every paper item must be examined to see in what way each company can use less paper.

Functional packaging must be the order of the day.

Sure, you have followed all the government directives on the subject. Even made cuts of your own. But, frankly, that isn't enough. Every time another ship leaves an American port loaded with paper-wrapped war supplies, the problem becomes tougher.

And it's up to you to join with the rest of industry to lick it. The War Advertising Council and the War Production Board have prepared a brief list of suggestions to help you. But you know your own business. You know how you can use less paper. ***It's up to YOU!***

TO GET MORE PAPER FOR . . .	USE LESS PAPER THESE WAYS
Blueprints for battleships	Eliminate slack fills.
"K" ration containers	Increase units per case to the maximum practical.
Signal Corps radio sets	Reduce separators to shoulder height.
Containers for shells	Eliminate carton liners if possible.
Gas mask canisters	Eliminate individual cartons wherever possible.
Disposable gun covers	Reduce weight of containers whenever compatible with safety.
V-mail envelopes	Do away with all unnecessary overlapping.
Blood plasma boxes	Set up a Paper Conservation Board in your plant.

This advertisement prepared under the auspices of the War Advertising Council in co-operation with the Office of War Information and the War Production Board.

Let's All Use Less Paper

Have you a REMOTE CONTROL problem?

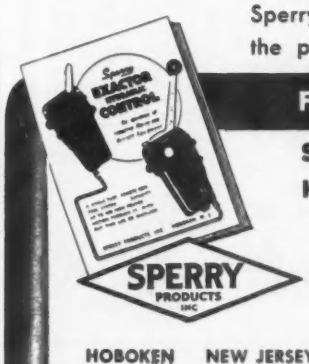
SPERRY'S EXACTOR HYDRAULIC CONTROL MAY SOLVE IT

Sperry's EXACTOR HYDRAULIC CONTROL, by means of a flexible, unique, single-tube system, has solved hundreds of remote control problems for design engineers in many industries.

Accurate and self-contained, requiring no special engineering to install or maintain, the EXACTOR HYDRAULIC CONTROL is well worth investigating.

Installation is simple and quick, because the EXACTOR uses tubing that can be bent *around* obstacles — thus eliminating all design problems. If *you* have a control problem involving the accurate transmission of applied motion over distances up to 200 feet, send for our completely descriptive booklet.

Sperry's EXACTOR HYDRAULIC CONTROL is rated at 400 inch-pounds on the pressure stroke and 125 inch-pounds on the spring-return stroke.



HOBOKEN NEW JERSEY

FILL OUT AND MAIL COUPON BELOW • NO OBLIGATION

A.A. EHC—0244

SPERRY PRODUCTS, INC.
HOBOKEN • NEW JERSEY

Gentlemen: Please send me, at no cost, a copy of your Bulletin 78-D containing complete details on your EXACTOR HYDRAULIC CONTROL.

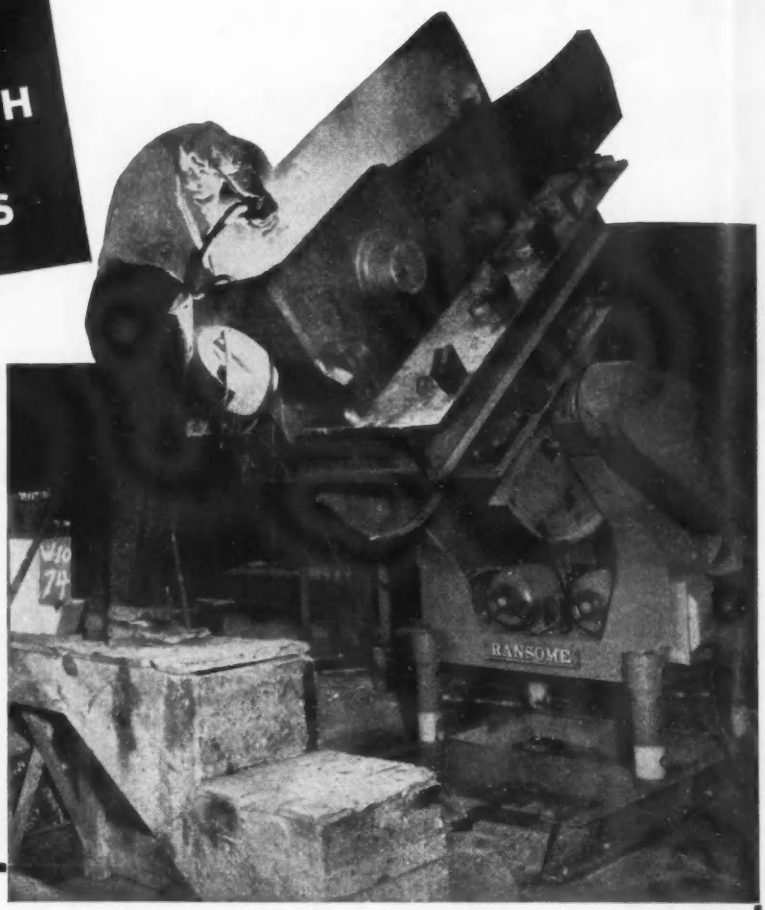
NAME ..... TITLE .....

COMPANY .....

ADDRESS ..... CITY ..... STATE .....

RANSOME WELDING POSITIONING EQUIPMENT

Now... HANDLED THROUGH WORTHINGTON DISTRICT OFFICES



The equipment that saves welders' time and energy and increases welding production by making it easy to shift work at will ...can now be obtained through Worthington Pump and Machinery Corporation District Offices and representatives in 36 cities.

With a Ransome Welding Positioner, many jobs can be done in one pass that used to take several, because the seam is always where it should be, in position for downhand welding. Result: smoother, stronger welds, more output with less effort.

There is a Ransome unit for every welding job.

Get in touch with the nearest Worthington office or representative

ATLANTA	CLEVELAND	HOUSTON	PITTSBURGH	SEATTLE
BALTIMORE	DALLAS	KANSAS CITY	PORTLAND, ORE.	SPRINGFIELD, MASS.
BIRMINGHAM	DENVER	LOS ANGELES	PROVIDENCE	SYRACUSE
BOSTON	DETROIT	NEW HAVEN	ST. LOUIS	TULSA
BUFFALO	EL PASO	NEW ORLEANS	ST. PAUL	WASHINGTON, D. C.
CHICAGO	FORT WORTH	NEW YORK	SALT LAKE CITY	WILMINGTON, DEL.
CINCINNATI	GALVESTON	PHILADELPHIA	SAN FRANCISCO	

Ransome WELDING POSITIONING EQUIPMENT

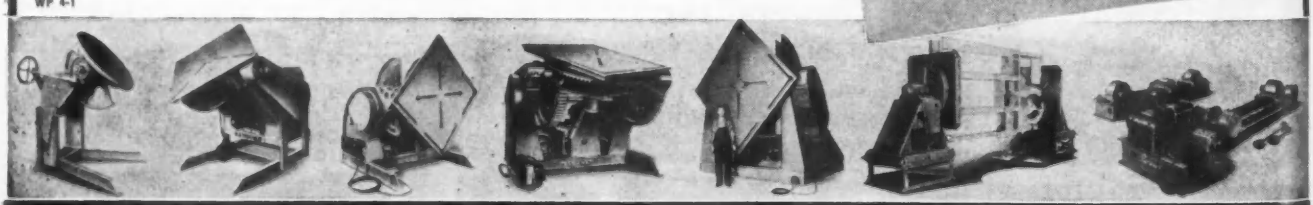
Industrial Division

RANSOME MACHINERY COMPANY, Dunellen, New Jersey

WP 4-1

Subsidiary of WORTHINGTON Pump and Machinery Corporation

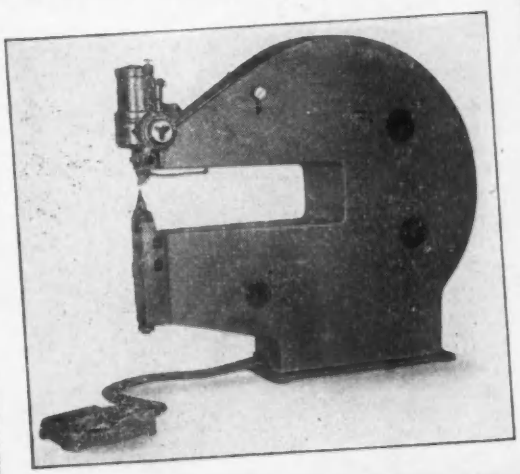
Power Plant Equipment • Turbines & Turbo Generator Sets • Diesel & Gas Engines • Pumps and Compressors • Air Conditioning & Refrigerating Equipment • Construction & Mining Machinery • Power Transmission Equipment • Liquid Meters



Capacities 500-lb. to 40,000-lb., hand-operated and motor-operated . . . Head-stocks and Tail-stocks . . . Turning Rolls

This is the Douglas C-54

ERCO Automatic Riveters put one million and ten rivets a day in Douglas-built planes!



RIVETING is one of the major problems in making today's all-metal aircraft. Modern sub-assembly methods and ERCO Automatic Punching and Riveting Machines have simplified the job.

ERCO Automatic Riveters eliminate separate drilling. . . reaming . . . press-countersinking . . . hand feeding . . . and heading operations. Many costly jigs and fixtures are no longer necessary. The whole job is done with ERCO's in *one* operation automatically.

You get clean, counter-sunk holes with coined edges. No drilling burrs . . . no irregular shaped holes. Rivets fit tight in the hole. All heads are uniform . . . rivet heads are concentric with rivet shank.

Riveting of sheet metal to extrusions with countersunk flush rivets can be performed at the same speeds as with plain rivets.

Other time and money-saving machines manufactured by Engineering and Research Corporation are ERCO Two-way Hydraulic Stretching Presses, Power and Foot Operated Shrinkers and Stretchers, Sheet Metal Formers and Propeller Profiling Machines.

Send today for complete catalogs

ERCO

ENGINEERING & RESEARCH CORPORATION

ARMY E NAVY

MAIN OFFICE & PLANT
RIVERDALE, MD.

WEST COAST OFFICE
LOS ANGELES, CAL.

Rawhide HAMMERS MALLETS

Carefully made, accurately balanced, with weighted heads where extra striking power is needed. Strike forceful blows without marring or battering, without recoil or bounce. Never split, chip, "smear" or crack, retain this true striking face so every blow goes right to the target . . . gets work done. Long wearing, mechanically cured, coiled Rawhide faces far outlast soft metals, plastics, wood or rubber.

Replaceable Heads

Replaceable Insert Faces are available for C/R Hammers . . . make each a "life-time" tool.

C/R Hammers and Mallets are classified as *essential tools* for the manufacture and maintenance of aircraft and other military material.

Write for Catalog Sheets

CHICAGO Rawhide MFG. CO.
1310 ELSTON AVE. ★ CHICAGO, ILLINOIS.

Goodyear Aircraft's Rapid Growth

(*Continued from page* 74)

ployes in this manner, having the turnover take place in the school rather than on the job, with less waste of time and material.

Goodyear Aircraft also has gone outside the normal labor market to fill its employment needs. Many physically handicapped workers, including deaf mutes, have been given jobs which they could adequately handle. A number of school teachers and more than 1500 school boys have been employed during the summer vacation period. Four-hour shifts in the late afternoon and early evening have been arranged for school boys during the school term.

Morale is maintained through a number of employe activities. A labor-management committee, with half the members from the company and half from the employe ranks, directs most of these projects. Among those in which it has participated are war bond drives, community war chest, employe suggestion plan and a company-wide family day, which attracted 101,842 visitors to the plants. War news is broadcast daily once each shift over an inter-plant network of 600 loud speakers. Special news bulletins and announcements also go over this network, the announcer being an Akron radio broadcaster who is employed in the Goodyear personnel department. A plant newspaper, the *Wingfoot Clan*, is published weekly and distributed to all employes.

In training supervision, Goodyear foremen sought out the most promising production workers and put them in a 12-week program for lead men. The most able lead men then were selected and placed in a pre-supervision course of 12 weeks. Usually they were promoted to supervisors before the end of the course if they showed any promise. Former design engineers were prepared for supervisory posts by teaching them human relations. Former salesmen and men from non-essential industries often were found in aircraft production jobs and some of them were qualified for foremen and supervisory training. A course for inspectors consisted of 30 per cent instruction and book work and 70 per cent actual experience on the job, becoming accustomed to factory environment.

With eight different aircraft contracts under way at once, Goodyear Aircraft's management was confronted with a real problem in knowing how each of these contracts stood at any particular time. A solution was found in the graphic management control plan conceived by Harry Blythe and developed by Lieut. George Fouche, then a Goodyear employe, and later adopted by the Navy's Bureau of Aeronautics as an ideal method of production control for aircraft contractors. Charts and graphs, comprising three racks of 25

Reduce Spoilage with G-E

Watch Dog
REG. U.S. PAT. OFF.

STARTERS

Is spoilage in your plant becoming a problem? Then check the condition of your lighting system. Blinking and flickering of dying fluorescent lamps irritate war workers, impair the quality of their workmanship and retard production. Today that's serious! Why tolerate such undesirable lighting conditions? You can banish annoying blink immediately and permanently by switching to the G-E Watch Dog Fluorescent Starters. *Here's what happens:*

When a lamp reaches the end of its useful life, blinking and flickering commence but the Watch Dog stops 'em cold! This manual reset starter cuts itself out of the circuit immediately by eliminating all flow of current.

This catalog will tell you how to use fluorescent accessories for best lighting results. You can obtain your copy by writing to Section G241-103, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

GENERAL ELECTRIC

Machine Re-Location Made Easy . . .

1. Send Felters a brief description and weight of the machine, measurements of the base or feet.

2. Felters will send by return mail, Unisorb pads of the proper density and size.

3. Cover both sides of Unisorb Felt pads with Eagle Brand Cement and that's all there is to it.

with FELTERS UNISORB

4 Place Unisorb Felt over floor pattern, set machine on floor.

No Bolts . . . No Seams No Damage to Floors

Compare the Unisorb way of anchoring machines shown above with the outdated method which employs boring . . . drilling . . . lagging—takes time, damages floors, transmits vibration from machine to floor.

The Unisorb method saves time, money, floors—cuts down machine vibration, reduces wear and repair, noise and fatigue—improves output in quality and quantity.

You should have a copy of "Unisorb in the Industrial Plant"—if you have not received one already, may we send you one—without obligation of course.

THE Felters Company

210-R SOUTH STREET • BOSTON, MASSACHUSETTS

Offices: New York, Philadelphia, Chicago, Detroit • Sales Representatives: Dallas, Los Angeles, Nashville, St. Louis, St. Paul • Mills: Johnson City, New York; Millbury, Massachusetts; Jackson, Michigan

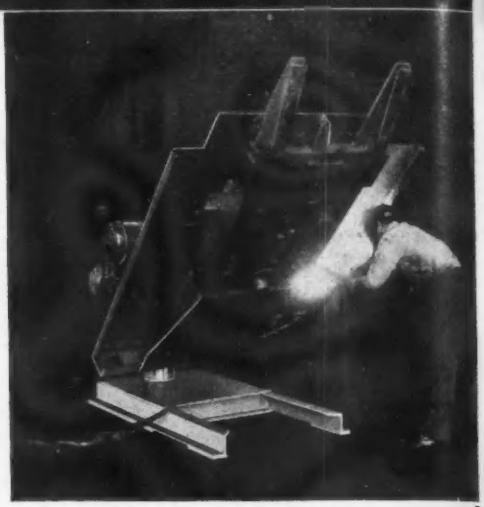
LAMINUM shims make it easier to keep your factory production machine or field service machine at top form.

Shims cut to your specifications. Stock shim materials obtainable from your dealer. Write us for further information and shim application chart.

Laminated Shim Company
Incorporated
51 Union Street • Glenbrook, Conn.

LAMINUM
THE SOLID SHIM THAT peels FOR ADJUSTMENT
2039

C-F POSITIONERS



Safety, Economy, Speed PLUS Better Welding!

A weldment can be no stronger than its weakest weld—and "down-hand" welding is your best assurance of strong flawless welds. That's why "positioned welded" is so frequently specified today!

C-F Positioners eliminate crews with slings and chains, clear your floor space, reduce accidents and *make every weld a faster, better weld!* The 135° beyond horizontal tilting feature of C-F Positioners combined with 360° table turn *assures* the proper welding position in even the most inaccessible corners!

Adaptable too! Heat treating, cutting, large pipe and boiler-handling problems and jobs where a continuous turn is necessary, are easily answered with a C-F Positioner. *You'll find new uses!* Many sizes and true-rated capacities. Hand or power operated. Write for catalog showing sizes, installations and many uses.

Write for Bulletin WP22

Cullen-Friestedt Co.
1322 S. Kilbourn Ave., Chicago 23, U. S. A.

charts apiece, are prepared to compare actual with scheduled deliveries and actual with scheduled installations on final assemblies, subcontracted items, Government-furnished equipment, minor assemblies by subcontractors, major assemblies and completed planes.

Each step in the manufacture of the first plane of a model is indicated by symbols on a chart, various colors indicating the different parts and the stage of completion. Other charts and graphs record the progress of new facilities under construction, the status of template and parts drawing deliveries, the delivery status on standard parts, raw materials, machined parts and miscellaneous parts. Similar charts show progress on tools and dies, jigs and fixtures, while a flow chart indicates the status of parts manufacturing. Personnel requirements also are charted as to requirements and actual hires in the various categories. Such charts must be continually kept up-to-date through frequent consultations with department heads involved.

Three sets of charts are maintained, one in the office of top management, one in the production control or planning department, and one in the department directly involved with that particular phase of the program. Goodyear Aircraft's management thus is able to know the status of any particular contract in comparison with the schedule on a specific date and this information also is readily available to the representatives of the Army Air Forces or Navy resident at the plant. Subcontractors or suppliers can be jogged if their deliveries are falling behind schedule, which is indicated by a quick look at the charts. The charts quickly show the need for pressure at some points and possible relaxation at others.

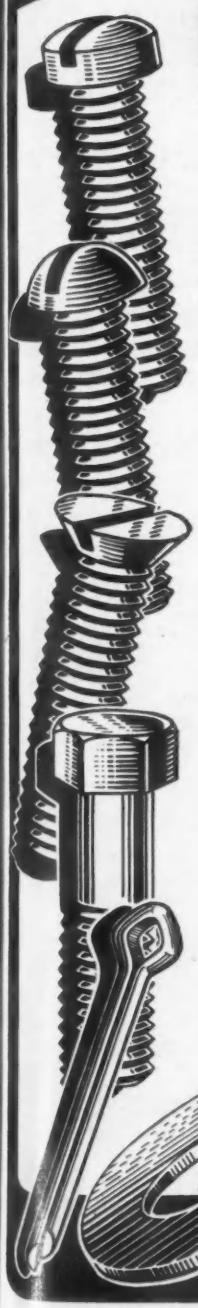
This management control has made Goodyear Aircraft Corp. an important unit in helping U. S. industry approach the high objectives set for 1943 airplane production.

AIRCRAFT IGNITION COMPONENTS
COMMUNICATIONS EQUIPMENT
CONNECTICUT TELEPHONE & ELECTRIC DIVISION.
Meriden — Connecticut

MAKE

STRONGHOLD SCREW PRODUCTS

A PART OF YOUR POST WAR PLANNING NOW!



IF your post-war production plans have reached the stage where you can anticipate your needs for screw products of definite types and sizes (or if you will let us help you in determining your post-war needs) you can protect yourself against delays in delivery by placing your requirements with us now for preferred handling when the restrictions on civilian production have been removed or relaxed. No priority is required.

Such orders are being accepted and held in file subject to current prices when definite delivery dates can be set.

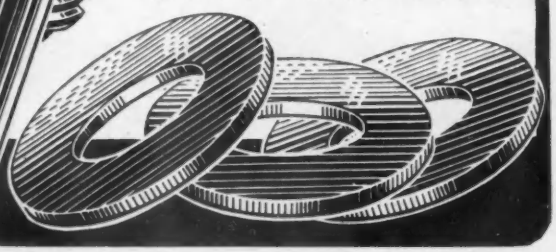
By ordering now you will be assured of prompt deliveries while others are still in the "blue-print" stage.

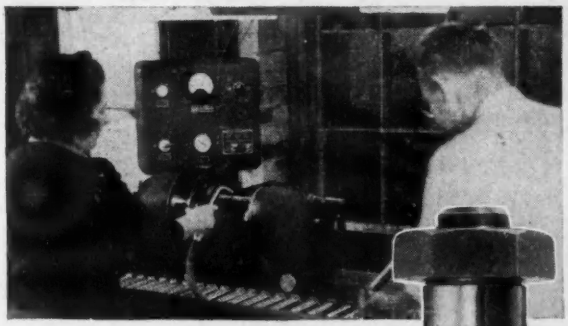
For your own protection—make "STRONGHOLD" a part of your post-war planning NOW!

A new STRONGHOLD catalog is in production. Is your name on our mailing list?

MANUFACTURERS SCREW PRODUCTS

201 West Hubbard Street ; Chicago 10, Ill.

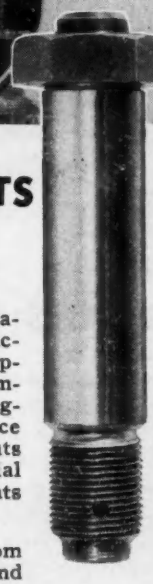




ONLY *Perfect* BOLTS PASS THIS TEST

RITCO's Magnaflux testing machine reveals the slightest structural defect. Such inspection equipment, together with RITCO's complete machine shop and drop forging facilities, enables us to produce vast quantities of fine bolts, nuts and studs—including many special types to the exacting requirements of the Aircraft Industry.

We can supply bolts and studs from ¼" to 2" diameter of any metal and in any quantity. Let us estimate to your specifications.



Remember RITCO *for*

SPECIAL BOLTS, NUTS & STUDS
DROP FORGING & DIE SINKING
SCREW MACHINE PRODUCTS
HEAT TREATING
SPRAYED METAL SERVICE
PARKERIZING

Estimates gladly submitted. Send samples or blueprints. Catalog on Request.

RHODE ISLAND TOOL COMPANY

148 West River St., Providence, Rhode Island

Serving American Industry Since 1834

RITCO

AS THE YEARS ROLL ON

There is a generous amount of thoroughly dependable reliability in every Layne Well Water System ever built! In the postwar years to come, that outstanding feature will be greatly appreciated by thousands of municipal and industrial executives. Even during the most strenuous days of war emergency, Layne quality was rigidly maintained.

There is more to a Layne Well Water System than reliability. In efficiency, they are beyond comparison. They lead the world in records of long life. Maintenance cost, year in and year out, is only a minor item.

Layne Well Water Systems are today serving the world's greatest cities, manufacturers, war plants, railroads, mines, naval stations, ship yards and training camps. In thousands of cases, both in this land and in foreign countries, they have met and far surpassed the most rigid requirements in quality, efficiency and low operation cost.

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WELL WATER SYSTEMS
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BUILDERS OF WELL WATER SYSTEMS FOR INDUSTRIES AND MUNICIPALITIES

BOOKS

(*Continued from page* 52)

A novel picture book with simple explanations dealing with the highly technical subject of petroleum chemistry and physics as applied to lubricants and fuels has just been published by *Petroleum Educational Institute* under the title SIMPLIFIED PETROLEUM CHEMISTRY AND PHYSICS.

The purpose of the book is to reduce to elementary language those fundamentals of chemistry and physics, a knowledge of which service and salesmen of modern lubricants and fuels must possess if they are to understand and intelligently apply these products in late model internal combustion engines to secure maximum efficiency and minimum cost of operation.

Another purpose of the book is to familiarize non-technical individuals with the fundamentals of chemistry and physics applied in catalytic, reforming and other recently developed processes employed in the manufacture of high anti-knock fuels for high-speed, high-compression engines. Also the processes used in the production of toluene and other petroleum products used in the manufacture of explosives and those employed in making butadiene and other products used in the manufacture of synthetic rubber.

No Machine and Tool Progress Exhibition

The annual meeting of the American Society of Tool Engineers has been scheduled for March 26 to 28, inclusive, in Philadelphia, Pa., with headquarters at the Bellevue Stratford Hotel.

Technical sessions are scheduled for both morning and afternoon on the 27th and 28th as well as the evening of the 27th. The annual banquet will be held Tuesday evening, March 28.

Condensation of the technical sessions of the annual meeting into only two days is in line with present conditions requiring the maximum possible conservation of time on the part of members of the technical organization while still securing the maximum interchange of information possible on current production problems.

In contrast with the last two years, no Machine and Tool Progress Exhibition is scheduled.

Goodrich to Handle Punch-Lok Hose Clamp

The Industrial Products Sales division of The B. F. Goodrich Company has been granted national distribution rights of the Punch-Lok hose clamp and method of applying it to hose of all types, electric cable and wire or textile rope.

The Punch-Lok hose clamp is a mechanical device used to connect various kinds of male and female fittings, special nipples, menders, or ordinary pipe to a hose. The connection will be as strong or stronger than the hose itself. Once the Punch-Lok hose clamp has been locked, vibration or rough handling will not loosen it.

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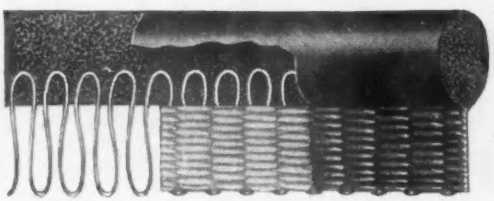

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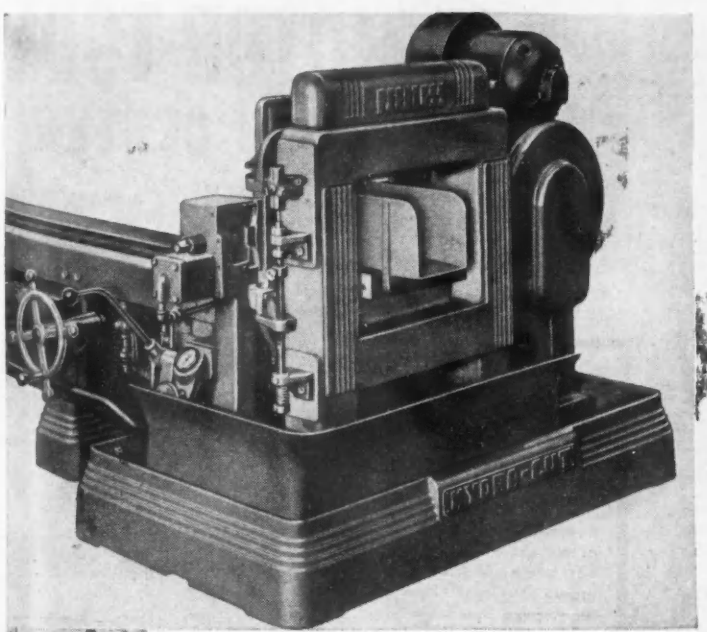

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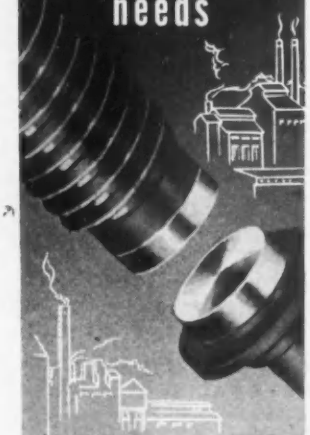

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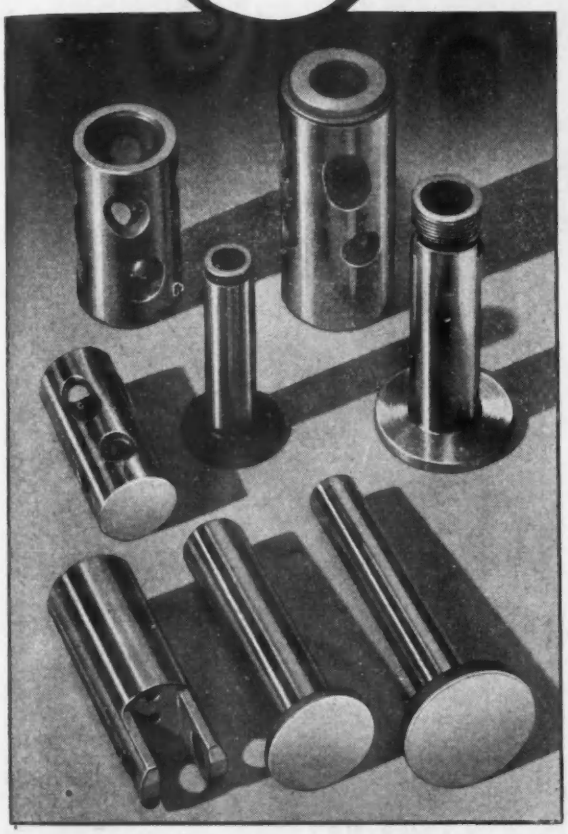

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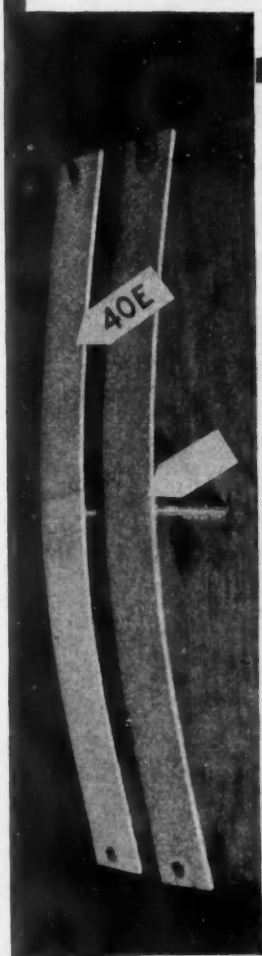

Frontier "40-E" under stress shows marked resistance to corrosion

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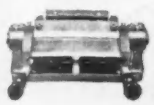

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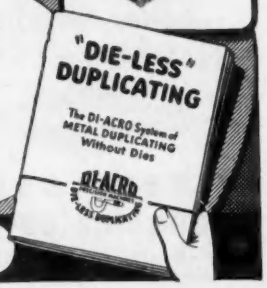

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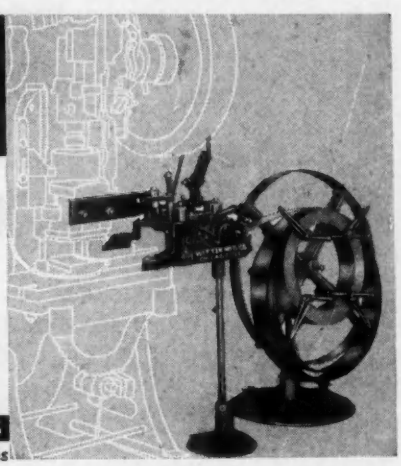

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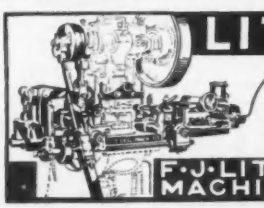

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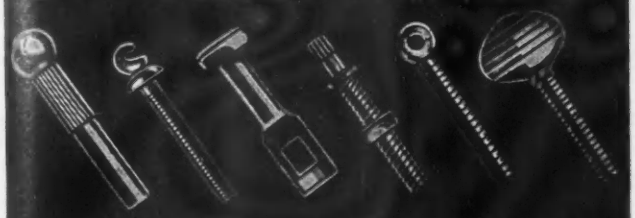

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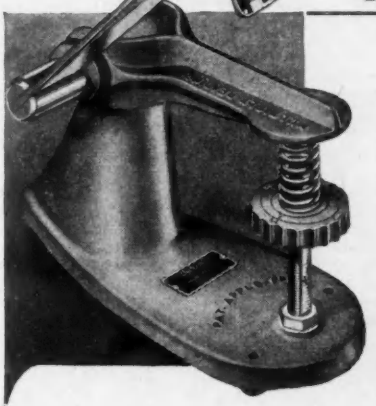

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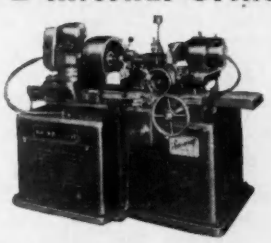

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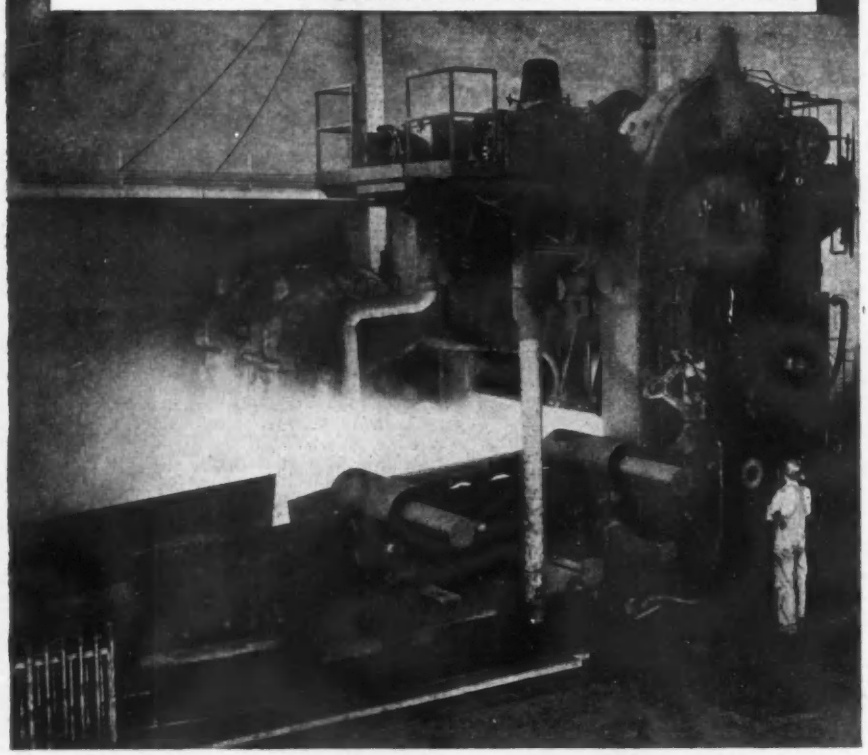
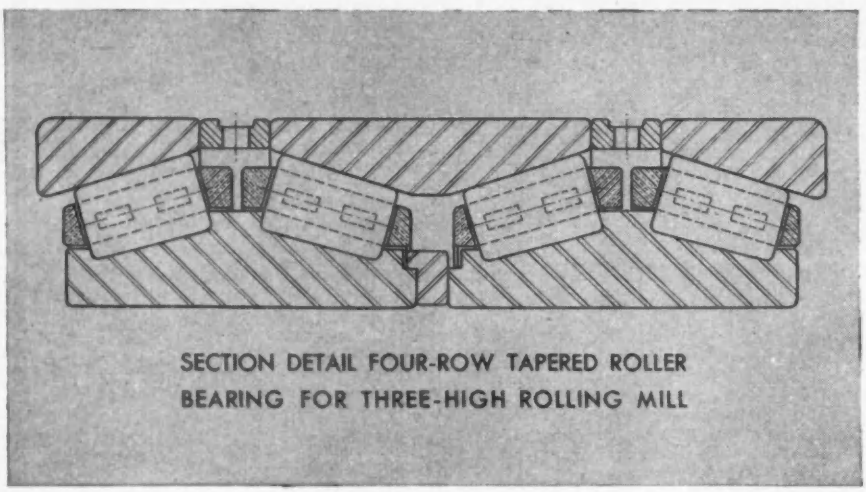
IN THE NEWS
WITH TORRINGTON BEARINGS

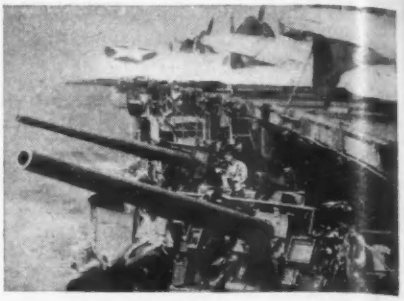


CALIFORNIA STEEL PLANT of Kaiser Company Inc.'s Iron & Steel Division went into operation last fall, rolling out steel sheets and plates for the West Coast industry's needs. This big, three-high rolling mill, built by Lewis-Foundry & Machine, is equipped with four-row tapered roller bearings illustrated below, designed and built by Torrington's Bantam Bearings Division.

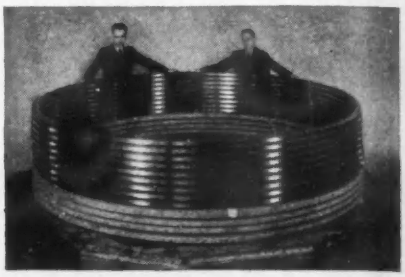


SECTION DETAIL FOUR-ROW TAPERED ROLLER BEARING FOR THREE-HIGH ROLLING MILL

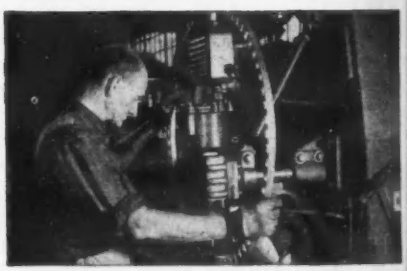
X-SECTION of the 21.500" OD 4-row tapered roller bearing used on the working rolls of the three-high mill shown at top. There are 43 rollers per row. Radial capacity at 100 R.P.M. is 550,000 pounds; thrust capacity, 168,000 pounds. Design and manufacture of large and special bearings to precision and ultra-precision limits is a major part of the service of Torrington's Bantam Bearings Division.



1. THE CURTAIN OF FIRE thrown up by anti-aircraft batteries of our modern Naval units is the most effective ever developed. The extreme accuracy and precision of the gun control mechanisms are aided by the use of anti-friction bearings like those shown below.



2. TEN FEET IN DIAMETER, these are races for gun mount bearings for the 5" twin anti-aircraft guns. Held to tolerances of .002" in diameter, .001" parallelism, Bantam engineers devised special methods for machining and gauging the giant rings where the change of a few degrees in temperature would cause dimensional changes greater than the specified tolerance.



3. RETAINING CAGES STAMPED FROM STEEL were also designed by Bantam engineers to reduce weight, conserve critical material. Shown here is a typical "stamped" cage for 33-inch diameter thrust roller gun mount bearing. Retaining cage for the 10-foot diameter bearings are of similar design, but constructed in eight segments and welded together on assembly. For your special bearing needs, you will find Torrington's experience in the design and manufacture of anti-friction bearings of every major type helpful in the solution of your bearing problems. TURN TO TORRINGTON for your bearing needs.

ARMY E NAVY

TORRINGTON BEARINGS

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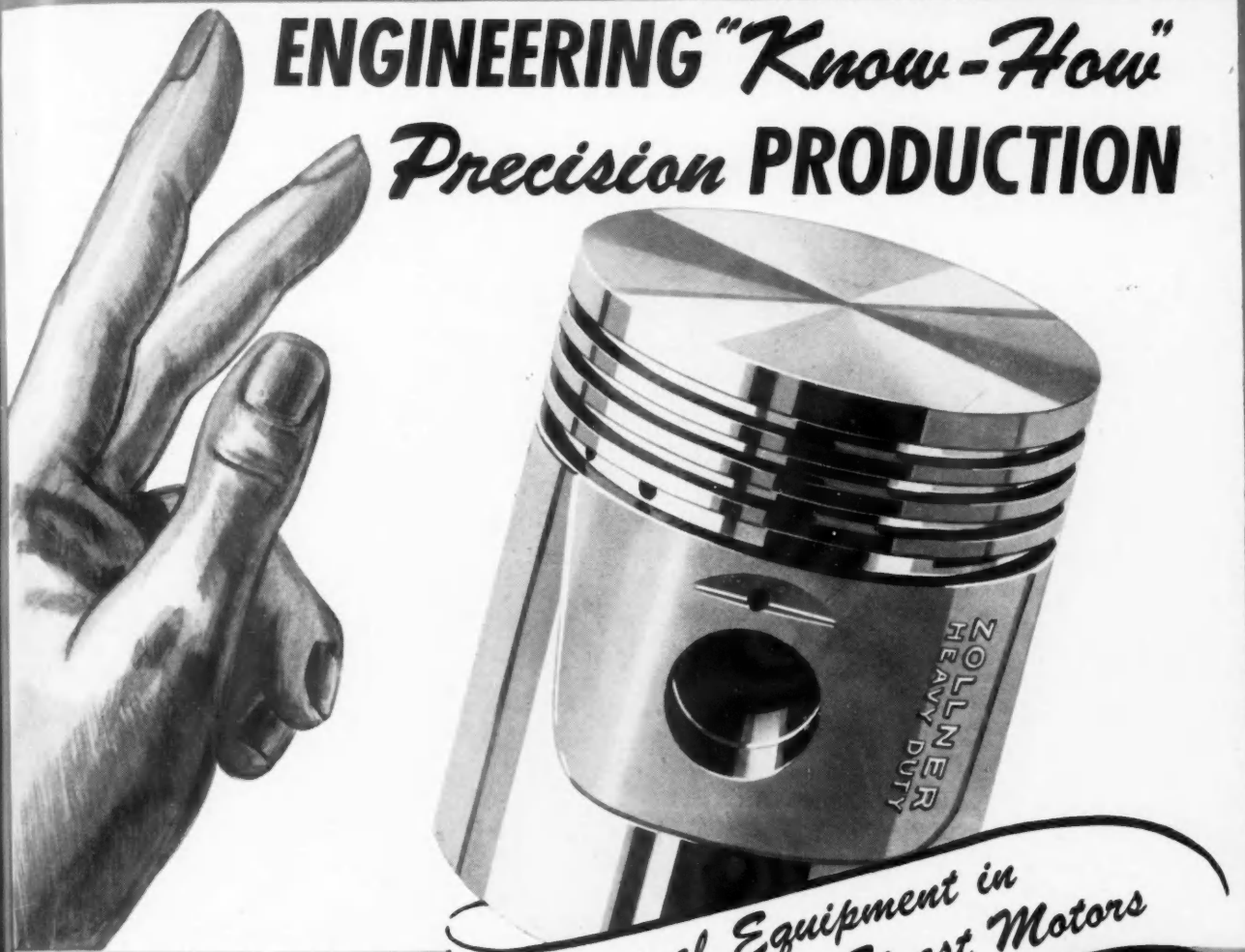
THE TORRINGTON COMPANY · BANTAM BEARINGS DIVISION

SOUTH BEND 21, INDIANA

ENGINEERING "Know-How" Precision PRODUCTION



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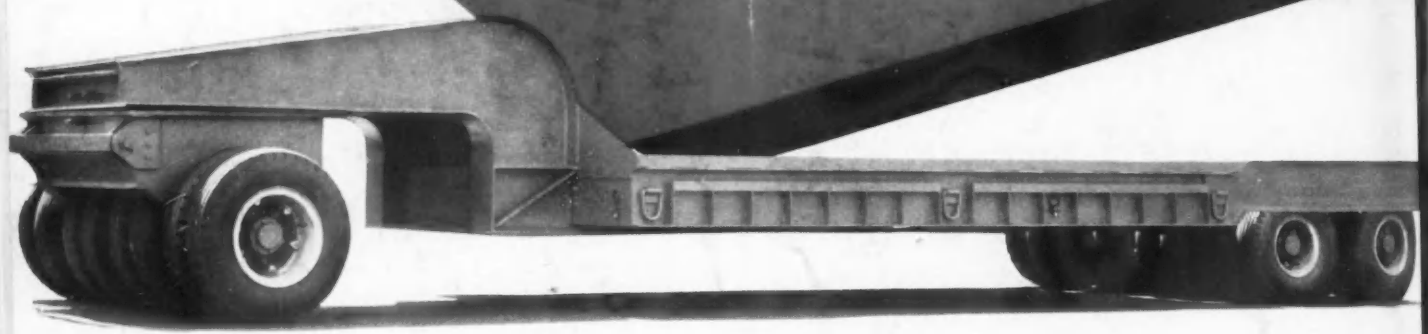

If you should ever see an Army trailer moving down the street with 90 jeeps piled up on its platform, don't be surprised—it *might* be the 90-ton Fontaine Trailer illustrated above!

Equipped with six Shuler Trunnion Axles, this brawny behemoth will move practically anything that's movable, and then bring it back if you wish!

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